1. GENERAL INFORMATION

1.1 Scope

This specification covers the method for testing the model JFC51 Afterburner Fuel Control 579400.

1.2 Equipment Required

Flow bench with a boost pump capable of supplying 10-70 psig fuel pressure to the main pumps in a closed loop system of operation. Main pumps capable of supplying 65000 PPH at 1000 psig pump discharge pressure. Two metered flow meters; Zone I and Zone II. Zone I meter must be accurate to 0.5% in the 3000 PPH to 50000 PPH range and the Zone II meter must be accurate to 0.5% in the 1500-25000 PPH range. A recirculation line flowmeter accurate to 1.0% in the 350-5000 PPH range. An internal leakage flowmeter accurate to 2.0% in the 350-3000 PPH range. Pump discharge pressure to be controlled as a function of pump controller output thru a system of relief valves in pump discharge line.

1.2.1 Test fluid will be PMC 9073. Maintain control inlet and flowmeter inlet at 100° ± 5°F. except as specified for hot testing.

1.2.2 Pneumatic pressure source and two gages for simulating engine burner pressure capable of maintaining for a minimum period of 0.5 hour any pressure between 10 and 300 PSIA. One gage 0 to 500 psia accurate to ± 0.25 psia. One gage 0 to 300 psia accurate to ± 0.25 psia over a range of 50 to 300 psia.

1.2.3 Constant temperature baths capable of maintaining temperature of -65°, 0°, +59°, and +150° within ± 5°F.

1.2.3.1 Temperature equipment to maintain temperature from +150°F. to +950°F. during hot testing. Temperatures to be accurate within ± 10°F.

1.2.4 Thermocouple and indicating unit with ±3°F. accuracy for measuring temperatures between -65°F. to +300°F. and with ±5°F. accuracy between +300°F. and 950°F.

1.2.5 Temperature cam calibration follower and dial indicator 560000 ET-7.

1.2.6 Gages for taking the following measurements within the specified accuracy.

1. Control proof pressure 0-1500 psi with 1.0% accuracy of full scale reading.

2. Control inlet pressure (P_{in}): 0-1000 psi with 1.0% accuracy of full scale reading.

1.2.6 (continued)

3. Control outlet pressure (P_{out}): Two gages Zone I and Zone II: 0-1000 psi with 1.0% accuracy of full scale reading.

4. Control body pressure P_{cb}): 0-150 psi with 1.0% accuracy of full scale reading.

5. Total flow throttle valve differential gage ($\triangle$ PTFTV): 0-80 psi with .75% accuracy of full scale reading.

6. Peak flow throttle valve differential gage ($\triangle$ PPFTV): 0-150 psi with .75% accuracy of full scale reading.

7. Pump controller differential gage: 0-200 psi with .75% accuracy of full scale reading.

8. Rig boost pressure (P_{rb}): 0-100 psi with 1.0% of full scale reading.

9. Spare Gages:

   1. 0-600 psi with 0.5% accuracy of full acale reading.
   2. 0-800 psi with 1.0% accuracy of full scale reading.
   3. 0-1000 psi with 1.0% accuracy of full scale reading (2 gages).

1.2.7 Separate pressure source capable of supplying 200 pph at fuel pressures of 50-750 psig.

1.2.8 Provisions for testing the control at +350°F. fuel temperature.

1.2.9 Back pressure schedule as indicated in Appendix D-1.

1.2.10 Sanborn Recorder.

1.2.11 X-Y coordinate plotter.

1.2.12 Angular position indicator to supply pump control output shaft position input to Sanborn recorder.

1.2.13 Preliminary Checks

1.2.13.1 The fuel control shall be assembled using the shimming procedures in HS 1594. The procedure is to act as a guide only, and may be varied as necessary to satisfy control calibration flow schedule requirements.

1.3 Test Requirements

1.3.1 The following readings shall be recorded at each calibration point.

1. Total metered fuel flow . . . . . Wft
2. Absolute burner pressure . . . . . PB

1.3.1 (continued)

3. Inlet bulb temperature . . . . . T_{T2}
4. Power lever angle . . . . . PLA
5. Compressor bleed position . . . . . CBA
6. Throttle valve differential . . . . . TVΔP
7. Pump controller differential . . . . . PCΔP

1.3.2 The following readings shall be recorded at the beginning and end of the variable input during calibration.

1. Control inlet pressure . . . . . PSIG . . . . . P_{in}
2. Control outlet pressure. . . . . PSIG . . . . . P_{out}
3. Test fluid temperature . . . . . °F.
4. Control body pressure. . . . . PSIG . . . . . P_{cb}

1.3.3 The following readings shall be recorded when noted:

1. Zone I fuel flow Wf1
2. Zone II fuel flow Wf2
3. Peak fuel flow . . . . . Wfp
4. Arming signal . . . . . PSIG
5. Transfer Point . . . . . Wf and PB
6. Pressure in recirculation line . . . PR

1.3.4 The following abbreviations, in addition to the foregoing are used in this specification:

1. Clockwise . . . . . CW
2. Counterclockwise . . . . . CCW
3. Military PLA . . . . . MAX (wide open throttle)

1.3.5 Accuracy of settings:

1. PB settings shall be held exact
2. T_{T2} settings shall be held to ±5°F.
3. Wf shall be read exact.

2. INSPECTION REQUIREMENTS

2.1 The items marked with an asterisk (*) in this specification are inspection items and as such must be under inspection surveillance.

2.2 Retest Requirements: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings listed under corresponding "Retest" must be retested and settings not yet tested must be completed.

Reset	Retest
PB Servo (8.0)	14.1.1, 14.2.1, 14.4.1, 14.4.2
Temperature Servo (9.0)	14.1.1, 14.4.1, 14.4.2
Total Flow T.V. (10.0)	14.1.1, 14.2.1, 14.4.1, 14.4.2
Zone II Transfer (12.0)	14.5.1, 14.5.2
Power Lever (6.1)	6.2, 6.3

Replace	Retest
Servo Housing	8.0, 14.1.1, 14.2.1, 14.4.1, 14.4.2
Temperature Servo	9.0, 14.1.1, 14.4.1, 14.4.2
Transfer Housing	12.0, 14.5.1, 14.5.2
Zone I Outlet Housing	14.8.2.1, 14.8.2.2
Zone II Outlet Housing	14.6.1, 14.8.1.3, 14.8.2.1, 14.8.2.2
Pump Controller	7.1, 7.2.1, 7.2.2

2.3 No adjustments or changes in parts shall be permitted during the final, inspected, test of the control.

3. INSTALLATION INSTRUCTIONS

3.1 Install control on drain table in a position similar to normal engine mounted position (Ref. P&WA layout 203578), connect Pump Discharge to control inlet, both outlets must be connected to separate flowmeters. Recirculation and internal leakage lines must also be connected to separate flowmeters.

3.2 Install 80 psi differential gage across the total flow throttle valve, 150 psi across peak throttle valve, also install 200 psi differential gage across the total flow T.V. and inline regulator.

3.3 Install a separate fuel pressure source to the speed signal valve.

3.4 Make sure that there are no open fittings on control and the internal leakage line is not "dead headed".

3.5 The flowmeter density adjustments shall be set in accordance with actual density measurements during both ambient and hot fuel tests.

4. EXTERNAL LEAKAGE

4.1 With PLA at Max A/B, set boost pump pressure to 60 ± 15 psig. There shall be no external leakage except:

a) No more than 10 DPM from the PB drain.
b) No more than 30 DPM from the Pump Controller Drain.

The term "no leakage" shall be devined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

5. PROOF PRESSURE TEST

* 5.1 With PLA at max., increase Wf to 10,000 ± 500 PPH. Close outlet valve until Pin is 1500 ± 20 psi. Maintain this pressure for a time period not to exceed 1 minute. There shall be no external leakage. Open outlet valve. The term "no leakage" shall be applied as defined in paragraph 4.1.

6. POWER LEVER SEQUENCE

6.1 Increase power lever angle until a position is reached where the PL Servo Piston moves .001-.005. Lock PL in place and adjust protractor slip ring until it reads 67°. At thisposition adjust the stop plate until the hole in the stop plate lines up with the slot in the index ring. Be sure protractor slip ring and stop plate are locked in position.

CAUTION: Be sure PL servo piston is not hitting the min. line stop (cover or screw in cover) when finding the .001 - .005 motion position. Check by turning PLS postion adj. cw until servo moves at least .020.

6.2 Set PLA = Max, PB = 15 psia. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust TOPV cam until the recirculation valve closes and the Zone I S.O.V. is open.

CAUTION: Torque on adjusting screws to be 15-20 in-lbs.

7. PUMP CONTROLLER CALIBRATION

7.1 Set PLA =max., PB = 18 psia. Adjust spring pre-load on pilot valve until P1 - P3 is 100 ± 2 psi. Repeat at PB = 50 and 100 psia differential pressure must remain at 100 ± 5 psi.

7.2 Dynamic Performance

* 7.2.1 Integral Rate

7.2.1.1 Disconnect the pump control shaft from the stand output flow control. Install the fixtures necessary to make Sanborne traces of pump control output shaft angle and $\triangle$P1-3. Set PLA at 120°, T_{T2} at +59°F., PB at 100 psia, bleeds closed.

7.2.1.2 Adjust the stand output flow control to create a $\triangle$P1-3 of 105 psi. When P.C. output shaft is near the center of its stroke make a step change to decrease $\triangle$P1-3 such that it is 5 to 9 psi below the P.C. setting. Obtain at least two sanborne recordings of this transient.

7.2.1.3 Put P.C. output shaft near the center of its stroke by varying $\triangle$P1-3, then make a step change to increase $\triangle$P1-3 such that it is 5 to 9 psi above the P.C. setting. Get sanborne recordings of this transient.

7.2.1.4 The integration rate of the P.C. output shaft shall be between 0.1 and 0.3 degrees per psi error per second.

* 7.2.2 Slew Rate Position

Disconnect Pump Controller Shaft from stand output flow control. Set PLA at Max., T_{T2} at +59°F., Pb at 100 psia, bleeds closed, adjust stand output flow to decrease $\triangle$P (1-3) the amount necessary to cause the Pump Controller Arm to move at its "Slew Rate". $\triangle$P(1-3) to get this slew rate shall be 18 to 22 psi below the Pump Controller setting. Shim under proportional piston spring to meet this requirement (Ref. Figure 31, H.S.1594). Maximum number of shims shall not exceed .130. If maximum shim thickness is exceeded, replace spring under the feedback piston with a lower dash numbered spring.

* 7.2.3 Slew Rate

Disconnect pump controller shaft from stand output flow control. Set PLA at Max., T_{T2} at +59°F., Pb at 100 psia, bleeds closed; adjust motor control to create $\triangle$P(1-3) of 105 psi. Obtain a transient recording of $\triangle$P(1-3) and pump controller output shaft angular position while making a rate change of 5 psi/sec (max) to decrease $\triangle$P(1-3) 25 to 30 psi below the pump controller setting. The angular rate of the pump controller output shaft shall be at least 90° per second.

7.3 Set PLA = max. Increase PB until Wf = 25000 pph. Adjust sensor for inline regulator until differential across total flow T.V. is 40 psi.

8. PB SERVO CALIBRATION

NOTE: Refer to Build-up Sheet for Dim. K (L-7208-12). If Dim. K is Plus (+) add this amount to the below PB pressures. If Dim. K is negative, subtract this amount to the below P_B pressures.

8.1 Set PLA = 68°, increase P_B to 30 psia ± K, bleeds closed. Adjust P_B position adjustment until cam follower is in bottom of the detent on the P_B cam.

NOTE: Bottom of detent is determined by change of motion on dial indicator. Bottom of detent is located at point where indicator reverses direction no more than (±.0001).

8.2 Increase P_B to 215 psia ± K. Shim C.B.A. pushrod until cam follower is in bottom of high P_B detent.

8.3 Repeat 8.1 and 8.2 until detents are set.

8.4 Set PLA = 68°, bleeds open. Vary P_B from 5 to 215 psia. Locate low and high P_B detents. Difference between detents must be 157 ± 2 psi. Adjust CBA pushrod ball follower until this difference is obtained.

8.5 Set the bleeds in the closed position and determine that the T_{T2} cam detents are still located at 30 ± K and 215 ± K psia.

8.6 Repeat items 8.1 thru 8.6 if required.

9. TEMPERATURE SERVO CALIBRATION

9.1 Set P_B = 30 psia ± K, PLA = max., T_{T2} = -65°F., bleeds closed. Adjust position spring on the T_{T2} input lever until the cam calibration follower just starts to come out of the detent (± .0001).

9.2 Set P_B = 30 psia ± K, PLA = Max., T_{T2} = +950°F., bleeds closed. Adjust rate spring on the flapper until the cam calibration follower just starts to come out of the detent (±.0001).

9.3 Repeat items 9.1 and 9.2 until the detents are set.

10. TOTAL FLOW THROTTLE VALVE CALIBRATION

10.1 Set P_B = 50 psia, PLA = 68°, T_{T2} = +59°F., bleeds closed. Record total flow T.V. displacement and total metered flow. Increase P_B until disp. changes .100. (T.V. rate is 95.4 PPH/.001.). Wf must change by 9540 PPH ± 100 PPH. Adjust inline sensor ΔP until set.

10.2 Bleeds closed, PLA = 0°, T_{T2} = +59°F., P_B = 200 psia. Recirculation flow must be 3000 PPH. Adjust minimum flow stop until this Wf is obtained.

10.3 Set bleeds closed, T_{T2} = -65°F. Set PLA = max. and read Wf at 50 and 90 P_B. Then set PLA = 68° and read Wf at 75 and 150 P_B. Plot these readings. A straight line drawn thru 50 and 90 on the max. line and 75 and 150 on the min. line must intersect at -2.75 psia and -200 pph. The actual intersection will be defined by finite values of Wf and P_B (Wf and Pb error).

10.4 Bleeds closed, T_{T2} = -65°F., P_B = 30 psia, PLA = max. Adjust T.V. multiplying lever hinge until Wf error is reduced to -200 pph.

10.5 If data lines determined in 10.3 do not intersect at -2.75 psia it will be necessary to reshim the T.V. multiplying lever hinge. Approximately .006 shims will change intercept 1 psi. Adding shims will move intercept to left (minus).

10.6 PLA = 68°, P_B = 100 psia, T_{T2} = +60°F., bleeds closed. Adjust power lever servo pilot valve position until Wf = 7420 PPH.

10.6.1 Set PLA = max., P_B = 100 psia, T_{T2} = -65°F., bleeds closed. Record Wf. Increase T_{T2} to +300°F. and record Wf. Differential Wf between -65°F. and +300°F. must be 6700 ± 250 pph. Adjust the T_{T2} cam bias adjustment until this differential is obtained. Set PL rate adj. to center of its travel before setting T_{T2} ball follower adj. screw.

10.7 Set PLA = max., P_B = 100 psia, T_{T2} = -65°F., bleeds closed. Adjust the power lever rate adjust (linkage bracket) until Wf = 43000 pph. At this time check stroke of the power lever servo. Stroke must be .900 ±.100 for full power lever movement.

10.8 Recheck 10.6 and 10.7, as slight trimming adjustment may be necessary.

* 10.8.1 Range of Remote Trim Adjustment (PL Servo Rate):
Set P_B = 100 psia, T_{T2} = +59°F, PLA = Max. Turn adjustment clockwise until it bottoms and record total Wf. Turn adjustment ccw until it bottoms and record total Wf. Limits: Adjustment range must be at least ±4% of Wf as calibrated. Range determined with this check must be recorded on the final data sheet. Note: Do Not repeat this test during final calibration.

10.9 Set P_B = 100 psia, T_{T2} = +59°F., bleeds closed. At these conditions increase PLA until Wf is 13300 pph. Adjust power lever stop to contact piston at this flow.

10.10 Bleeds closed, T_{T2} = -65°F., Repeat 10.3. Adjust T.V. multiplying lever hinge until the intercept occurs at -2.75 psia and +5,900 pph.

10.11 Set P_B = 23 psia, PLA = Max., T_{T2} = +750°F., bleeds closed. Wf must be 12075-12700 pph. Trim to obtain this Wf by a P.L. servo position adjustment.

11. POWER LEVER TORQUE

11.1 Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

13. PEAK THROTTLE VALVE RATE

13.1 Set PLA = Max., P_B = 50 psia, T_{T2} = +59°F., bleeds closed. Record Wf in Zone I. Increase P_B to 150 psia and record Wf in Zone I. Difference in Wf between 50 and 150 P_B must be 25000-26000 pph. Adjust peak valve sensor until this difference is obtained.

13.2 Plot peak line with bleeds closed. Intercept with fuel flow axis, at P_B = 0 psia, should not be off more than 300 pph in either direction. If intercept is off more than ± 300 pph, reshim 3-D cam to correct error (Wf error/28 = shims).

14. FINAL CALIBRATION

NOTE: *1. A body pressure of 50 ± 20 psig shall be maintained throughout final calibration.

*2. No adjustments or changes of parts shall be permitted during the final calibration.

*3. Prior to final calibration all external screws which affect calibration settings shall be lockwired.

14.1 Max. Ratio Calibration - Bleed Closed

* 14.1.1 Set PLA = Max., T_{T2} =+59°F., bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. ΔP at the following P_B pressures (Note: Approach P_B pressures in increasing direction) P_B = 15, 20, 40, 60, 80, 100, 120, 140, 180, 140, 80, 40, 20 and 15 psia. See Appendix A-1 for limits. Hysteresis must be within limits defined in Appendix A-1. Record return to Pump Inlet Flow at 20 and 180 psia. Do Not overshoot when setting P_B pressures.

* 14.1.2 Set PLA = Max., bleeds closed, P_B = 100 psia, T_{T2} less than 20°F. Increase T_{T2} to [illegible]°F., allow to stabilize for at least one minute and record fuel flow. Increase T_{T2} to +150°F., hold for at least one minute, then reduce it to +59°F. Allow one or more minutes to stabilize and record fuel flow. Limits shall be as defined in Appendix A-1 for P_B = 100 psia.

14.2 Min. Ratio Calibration - Bleeds Closed

* 14.2.1 Set PLA = 67°, T_{T2} = +59°F., bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. ΔP at the following PB pressures: 15, 20, 40, 100, 180, 100, 40, and 15 psia. See Appendix B-1 for limits. Hysteresis must be within the limits defined in Appendix B-1. (Note: Do Not overshoot when setting PB pressures.)

14.3 Power Lever Sequence and Transient

* 14.3.1 Set PLA = Max., T_{T2} = +59°F., P_B = 18 psia, bleeds closed. Decrease PLA to 0° then slowly increase PLA. At 66° - 67°, the recirculation valve must close at or after the time at which the Zone I manifold S.O.V. opens. Increase PLA to Max. Slowly decrease PLA and record PLA at which S.O.V. closes. PLA must be within 65° - 67° when S.O.V. closes. Recirculation valve must open at or before the time at which the S.O.V. closes.

* 14.3.2 Set arming signal at 0 to 50 psig, PLA = 0°, T_{T2} = +59°F., P_B = 20 psia. Now advance the power lever to approximately 75°. Slowly increase arming signal pressure until the S.O.V. opens and record this pressure. Limits: The pressure must be between 30 and 110 psig above body pressure.

* 14.3.3 Set Pb = 100 psia and T_{T2} = +59°F. Change PLA from 68° to max. within .8 to 1.2 seconds. The control fuel flow shall increase at a rate not to exceed 300 Wf/Pb ratios per second and complete 90% of the transient in 2 seconds or less.

* 14.3.4 Set Pb = 100 psia and T_{T2} = +59°F. Change PLA from Max. to 68° within .8 to 1.2 seconds. The control fuel flow shall complete 90% of the transient in 2 seconds or less.

* 14.3.5 Set Pb = 100 psia and T_{T2} = +59°F. Bleeds closed. Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

14.4 Temperature (T_{T2}) Sensing Calibration - (See Appendix C-1 for Limits)

Note: All temperatures (T_{T2}) to be actual bulb temperature for final calibration.

* 14.4.1	Set PLA = max, T_{T2} = -65°F, bleeds closed. Record total metered Wf at the PB pressures noted in Appendix C-1 (Note: Approach PB pressures in increasing direction.)
* 14.4.2	Repeat item 14.4.1 at temperatures (T_{T2}) of 200°F.
14.4.3	Repeat item 14.4.1 with bleeds open at T_{T2} of 200°F., 300°F., 500°F. and 750°F. Include hysteresis on 750°F line.
* 14.4.4	The force required to open and close CBA pushrod shall not exceed 20 lbs., when body pressure is at 50 psig.
14.6	Recirculation Calibration
*14.6.1	Set PLA = 0°, PB = 100 psia, T_{T2} = +59°F, bleeds closed. Metered WF must be 2850 - 3150 pph. Record control inlet pressure and control body pressure. Control inlet pressure must be within 80 - 200 psi above control body pressure.
14.7	Repeatability Checks
* 14.7.1	Check repeatability in accordance with and in sequence indicated in Appendix E-1.
* 14.7.2	Re-run per paragraph 14.7.1 two additional times. Re-run paragraph 14.7.1 a total of 9 additional times only if requested by HS Engineering. Cycle bleeds open to bleeds closed twice before starting each re-run.
14.8	Leak Check
* 14.8.1	With all instrumentation removed from control, set the PLA at Max, set PB at 150 psia, T_{T2} at + 59°F., bleeds closed.
* 14.8.1.1	Check external leakage. No leakage allowed except for pump controller drain and PB drain. The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.
* 14.8.1.2	Check overboard drain leakage. Allowable leakage shall be no more than 10 dpm from the P_B drain and 30 dpm from the pump controller drain.
* 14.8.1.3	Remove recirculation line from the control and check recirculation valve leakage. Leakage from the recirculation port must not exceed 20 cc/min.
* 14.8.1.4	Pressurize overboard drain port on pump controller to 10 psig. The external leakage shall not be greater than 8 dpm per seal.

* 14.8.2 Shut-Off Valve Leakage

Note: Allow ten minutes for lines to drain before taking leakage reading.

* 14.8.2.1 Set PLA = 0°, T_{T2} = +59°F, PB = 15 psia, bleeds closed, with main and boost pumps operating. Remove Zone I outlet line. Leakage in Zone I must not exceed 10 dpm. Shut down main pump.

* 14.8.2.2 Set PLA=0°, T_{T2} = +59°F, PB = 15 PSIA. Maintain boost pressure at 50 psig. Remove Zone I outlet line. Leakage must not exceed 10 dpm.

14.9 Power Lever Cam Calibration Check

* 14.9.1 Set PB of 100 psia, T_{T2} = +59°F. Set, in sequence, power lever angles of 68°, 80°, 90°, 100°, 110°, 120°, 100°, 80°, 68°. Record total Wf at each point.

* 14.10 The "K" dimension used in setting up the PB system position must be recorded on the final data log sheets.

14.11 Hot Test Requirements

14.11.1 The following items shall be run three times in the following sequence. First with fuel temperature at 100 ± 5°F, then with fuel temperature at 325 - 350°F, then with fuel temperature at 100 ± 5°F. All runs are to be made at room temperature ambient conditions.

* 14.11.1.1 Set PLA at Max, T_{T2} at +59°F, bleeds closed. Record total flow at the following CDP pressures: 20, 60, 100, 120 psia. Note: Set CDP in the increasing pressure direction. See Appendix A-1 for limits.

* 14.11.1.2 Set PLA at max, T_{T2} at +750°F, bleeds open. Record total flow at the following CDP pressures: 20, 30, 50, 100 hysteresis 50, 30 and 20 psia. See Appendix C-1 for limits.

14.11.2 Repeat paragraph 14.3.2 to be sure speed signal valve is still operative.

15. PRESERVATION AND STORAGE

15.1 At conclusion of bench calibration, drain the calibration fluid from the control and prepare the control for shipment in accordance with H.S. Specification 380.

NOTE: Controls which have been insulated prior to running final bench calibration data must be heated in a ventilated oven at 250° ± 10°F. for a period of 1 to 1½ hours after draining calibrating fluid from the control.

* 15.2 The "dry weight" of the control shall be recorded on the installation inspection sheet.

APPENDIX A-1

P_B	Conditions	Total Wf Limits
15		5970 - 6600
20	T_{T2} = +59°F.	7880 - 8720
40	Bleeds	15540 - 17180
60	Closed	23250 - 25700
80	PLA = Max.	31050 - 34300
100		38000 - 42800
120		45900 - 50700
140		53500 - 59000

APPENDIX B-1

P_B	Conditions	Total Wf Limits
15		2850 - 3150
20	T_{T2} = +59°F.	2850 - 3150
40		5050 - 5600
100	Bleeds closed	12600 - 14000
180	PLA = 68°	22700 - 25150

APPENDIX C-1

Temperature Sensing Calibration

T_{T2} = -65°F. B.C.

P_B	Total Wf Limits
15	7460 - 8250
20	9920 - 10960
60	28600 - 31650
100	47000 - 52000
120	56300 - 62200

T_{T2} = +300°F. B.O.

P_B	Total Wf Limits
15	7380 - 8160
20	9850 - 10900
60	28600 - 31600
100	44700 - 49500
120	53200 - 58850

APPENDIX C-1

(Continued)

T_{T2} = 200°F. B.C.

P_B	Total Wf Limits
15	5900 - 6530
20	7970 - 8810
60	23940 - 26470
100	38900 - 43000
150	56600 - 62600

T_{T2} = 500°F. B.C.

P_B	Total Wf Limits
15	7820 - 8650
20	10380 - 11480
60	27800 - 29850
100	44380 - 49050
120	53100 - 58680

T_{T2} = +750°F. B.C.

P_B	Total Wf Limits
15	6910 - 7650
20	8960 - 9910
30	13730 - 14440
50	22330 - 23960
100	43350 - 47900
120	51700 - 57200

T_{T2} = 200°F. B.C.

P_B	Total Wf Limits
15	The observed flow readings shall be 17 1/2 to 19 1/2% higher than the observed flow readings for T_{T2} = +200°F. B.C.
20	
60	
100	

NOTE: Hysteresis Wf must be within specified limits.

APPENDIX D-1

Wf	Zone I Injection Manifold (psi)
3000	90 - 110
6000	140 - 165
10000	195 - 225
20000	300 - 345
30000	390 - 440
40000	460 - 520

APPENDIX E-1

	(PSIA) P_B	Conditions	Total PPH Wf Limits
1)	20	(T_{T2} =+59°F. B.C.)	7880 - 8720
	120	PLA = Max.	45900 - 50700
2)	20	(T_{T2} =+750°F. B.C.)	8960 - 9910
	120	PLA = Max.	51700 - 57200

HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT

H.S. 2097
Amend. /
Page 1 of 10
E.C. 72922
Date: 9-22-62

H.S. 2097 Afterburner Control JFC 51 Acceptance of

Amendment /

1. Change paragraph 1.2.3 to read:

"1.2.3 Constant temperature baths capable of maintaining temperature of -65°, +59°, and +200° within ± 5°F."

2. Change paragraph 1.2.3.1 to read:

"1.2.3.1 Temperature equipment to maintain temperature from +200°F. to +950°F. during hot testing. Temperatures to be accurate within ± 10°F."

3. Change paragraph 1.2.11 to read:

"1.2.11 An Orifice sized to flow 170 ± 10 PPH with a ΔP of 75 PSI across it."

4. Add paragraph 1.2.13 to read as follows:

"1.2.13 Power Lever Protractor- 5° to 130° graduated in 1° increments."

5. Change old paragraph 1.2.13 to read:

"1.2.14"

6. Change paragraph 1.2.13.1 to read:

"1.2.14.1"

7. Change paragraph 1.3.3 to read:

"1.3.3 The following readings shall be recorded when noted:

1. Arming signal. . . . . .PSIG
2. Pressure in recirculation line. . . . . PR"

8. Change paragraph 2.2.2a to read:

"2.2 Retest Requirements: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings listed under corresponding "Retest" must be retested and settings not yet tested must be completed."

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Reset	Retest
PR Servo (8.0)	12.1.1, 12.2.1, 12.4.1, 12.4.2
Temperature Servo (9.0)	12.1.1, 12.4.1, 12.4.2
Total Flow T.V. (10.0)	12.1.1, 12.2.1, 12.4.1, 12.4.2
Power Lever (6.1)	6.2, 6.3

Replace	
Servo Housing	8.0, 12.1.1, 12.2.1, 12.4.1, 12.4.2
Temperature Servo	9.0, 12.1.1, 12.4.1, 12.4.2
Transfer Housing	12.0, 12.5.1, 12.5.2
Zone I Outlet Housing	12.8.2.1, 12.8.2.2
Zone II Outlet Housing	12.8.1.3
Pump Controller	7.1, 7.2.1, 7.2.2""

9. Change paragraph 3.2 to read:

"3.2 Install 80 PSI differential gage across the total flow throttle valve, and install 200 PSI differential gage across the total flow T.V. and fuline regulator."

10. Add paragraph 3.6 to read as follows:

"3.6 The Orifice specified in paragraph 1.2.11 shall be installed in a line connected between the tap on the recirculation valve cover and the external connection mounted on the Zone I cover."

11. Add paragraph 6.3 to read as follows:

"6.3 Check to be sure that the Power Lever stops on the external stop plate. If it doesn't stop externally (at 125° end of rotation) adjust the TOPV one turn CCW, then readjust the TOPV cam per paragraph 6.2 and recheck. Repeat if necessary.

If the Power Lever does not stop externally at the -5° position, follow the above procedure except that the TOPV will be turned CW."

12. Change paragraph 10.1 to read:

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"12. ~~10.5~~ Set P_B = 50 psia, PLA = 60°, T_{T_2} = +59°F., bleeds closed. Record total flow T.V. displacement and total metered flow. Increase P_B until disp. changes .100. (T.V. rate is 90 PPH/.001). Wf must change by 9000 PPH ± 100 PPH. Adjust inline sensor ΔP until set."

13. Change paragraph 10.6 to read:

"10.6 PLA = 67°, P_B = 100 psia, T_{T_2} = +59°F., bleeds closed. Adjust power lever servo pilot valve position unti Wf = 7000 PPH."

14. Change paragraph 10.6.1 to read:

"10.6.1 Set PLA = max., P_B = 100psia, T_{T_2} = -65°F., bleeds closed. Record Wf. Increase T_{T_2} to + 300 °F. and record Wf. Differential Wf between -65°F. and + 300°F.,B.C., must be 9000 ± 250 PPH. Adjust the T_{T_2} cam bias adjustment until this differential is obtained. Set PL rate adj. to center of its travel before setting T_{T_2} ball follower adj. screw."

15. Change paragraph 10.7 to read:

"10.7 Set PLA = max., P_B = 100psia, T_{T_2} = -65°F., bleeds closed. Adjust the power lever rate adjust (linkage bracket) until Wf = 49500 pph. At this time check stroke of the power lever servo. Stroke must be .900 ± .100 for full power lever movement."

16. Delete paragraph 10.10.

17. Change paragraph 10.11 to read 10.10:

"10.10 Set P_B = 23 psia, PLA = Max., T_{T_2} = +750°F., bleeds open. Wf must be 9800-10800 pph. Trim to obtain this Wf by a P.T. servo position adjustment."

18. Delete paragraphs 13., 13.1, and 13.2.

19. Change paragraph 14 to read:

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20. Change paragraph 14.1 to read:

"12.1"

22. Change paragraph 14.1.1 to read:

"12.1.1 Set PLA = Max., T_{T2} = +59°F., bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. ΔP at the following P_B pressures (Note: Approach P_B pressures in increasing direction) P_B = 15, 20, 40, 60, 80, 100, 120, 140, 160, 120, 80, 40, 20 and 15 psia. See Appendix A-1 for limits. Hysteresis must be within limits defined in Appendix A-1. Record return to Pump Inlet Flow at 20 and 160 psia. Do not overshoot when setting P_B pressures.

23. Change paragraph 14.1.2 to read:

"12.1.2"

24. Change paragraph 14.2 to read:

"12.2"

26. Change paragraph 14.2.1 to read:

"12.2.1 Set PLA = 68°, T_{T2} = +59°F., bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. ΔP at the following PB pressures: 15, 20, 40, 100, 160, 100, 40, and 15 psia. See Appendix B-1 for limits. Hysteresis must be within the limits defined in Appendix B-1. (Note: Do Not overshoot when setting PB pressures.)"

27. Change paragraph 14.3 to read:

"12.3"

28. Change paragraph 14.3.1 to read:

[illegible] Afterburner Control [illegible]

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29. [illegible] Set PLA = Max., T_{t2} = +59°F., P_{t2} = 18 psia, bleeds closed. Decrease PLA to 0° then slowly increase PLA. At 66° - 67° the recirculation valve must close at or after the time at which the Zone I manifold S.O.V. opens. Increase PLA to Max. Slowly decrease PLA and record PLA at which S.O.V. closes. PLA must be within 65° -67° when S.O.V. closes. Recirculation valve must open at or before the time at which the S.O.V. closes. At 67° insert the Indexing pin thru the slot in the Indexing ring and into the stop plate hole."

30. Change paragraph 14.3.2 to read:

"12.3.2"

31. Change paragraph 14.3.3 to read:

"12.3.3"

32. Change paragraph 14.3.4 to read:

"12.3.4"

33. Change paragraph 14.3.5 to read:

"12.3.5"

34. Change paragraph 14.4 to read:

"12.4"

35. Change paragraph 14.4.1 to read:

"12.4.1"

36. Change paragraph 14.4.2 to read:

"12.4.2"

37. Change paragraph 14.4.3 to read:

[illegible]

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39. Change paragraph 14.6 to read:
"12.6"

40. Change paragraph 14.6.1 to read:
"12.6.1"

41. Change paragraph 14.7 to read:
"12.7."

42. Change paragraph 14.7.1 to read:
"12.7.1"

43. Change paragraph 14.7.2 to read:
"12.7.2"

44. Change paragraph 14.8 to read:
"12.8"

45. Change paragraph 14.8.1 to read:
"12.8.1"

46. Change paragraph 14.8.1.1 to read:
"12.8.1.1"

47. Change paragraph 14.8.1.2 to read:
"12.8.1.2"

48. Change paragraph 14.8.1.3 to read:
"12.8.1.3"

49. Change paragraph 14.8.1.4 to read:
"12.8.1.4"

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50. Change paragraph 14.8.2 to read:

"12.8.2"

51. Change paragraph 14.8.2.1 to read:

"12.8.2.1"

52. Change paragraph 14.8.2.2 to read:

"12.8.2.2"

53. Change paragraph 14.9 to read:

"12.9"

54. Change paragraph 14.9.1 to read:

"12.9.1"

55. Change paragraph 14.10 to read:

"12.10"

56. Change paragraph 14.11 to read:

"12.11"

57. Change paragraph 14.11.1 to read:

"12.11.1"

58. Change paragraph 14.11.1.1 to read:

"12.11.1.1"

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60. Change paragraph 14.11.1.2 to read:

"12.11.1.2 Set PLA at max, T_{T2} at + 750°F, bleeds open. Record total flow at the following CDP pressures: 20, 30, 50, 100, 120 hysteresis 100, 50, 30 and 20 psia. See Appendix C-1 for limits."

62. Change paragraph 14.11.2 to read:

"12.11.2 Repeat paragraph 12.8.2 to be sure speed signal valve is still operative."

63. Change paragraph 15 to read:

" 13 "

64. Change paragraph 15.1 to read:

"13.1"

65. Change paragraph 15.2 to read:

" 13.2"

66. Change Appendix A-1 to read:

P_{B}	Conditions	Total Wf Limits
15	T_{T2} = +59°F	5970 - 6600
20	Bleeds	7880 - 8720
40	Closed	15540 - 17180
60	PLA= Max.	23300 - 25800
80		31050 - 34300
100		38600 - 42800
120		45900 - 50700
140		53500 - 59000
160		57000 - 63000

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67. Change Appendix B-1 to read:

P_B	Conditions	Total Wf Limits
15	T_{T2} = +59°F Bleeds closed PLA = 68°	2850 - 3150
20		2850 - 3150
40		5050 - 5600
100		12600 - 14000
160		20200 - 22400

68. Change Appendix C-1 to read:

Temperature Sensing Calibration

T_{T2} = - 65°F., B. C.

P_B	Total Wf Limits
15	7460 - 8250
20	9920 - 10960
60	28600 - 31650
100	47000 - 52000
120	56300 - 62200
160	57000 - 63000

T_{T2} = + 300°F., B. O.

P_B	Total Wf Limits
15	7380 - 8160
20	9850 - 10900
60	28600 - 31600
100	44700 - 49500
120	53300 - 59000

T_{T2} = +200°F., B. C.

P_B	Total Wf Limits
15	5900 - 6530
20	7950 - 8800
60	23940 - 26470
100	39000 - 43200
120	45900 - 50800
150	56600 - 62600

T_{T2} = +500°F, B.O.

P_B	Total Wf Limits
15	7800 - 8700
20	10300 - 11500
60	27400 - 30400
100	41400 - 46200
120	53000 - 58700

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T_{T2} = + 750 °F, B.O. T_{T2} = + 200° F., B. O.

P_B	Total Wf Limits	P_B	Total Wf Limits
15	6900 - 7660	15	7020 - 7780
20	8960 - 9920	20	9440 - 10460
30	13720 - 14440		
50	22300 - 24000	60	28500 - 31500
100	43300 - 47900	100	45900 - 50100
120	51700 - 57200	120	54300 - 60100

NOTE: Hysteresis Wf must be within specified limits.

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Amendment 2

1. Change paragraph 8.4 to read:

8.4 "Set PLA = 68°, bleeds open. Vary PB from 5 to 215 psia. Locate low and high PB detents. Difference between detents must be 157 ± 2 psi. Adjust GBA pushrod ball follower until this difference is obtained. The low detent must occur 5 to 7 psi below the bleeds closed detent position.

2. Change paragraph 12.9.1 to read:

*12.9.1 Set PB of 100 psia, TT2 = +59°F. Set, in sequence, power lever angles of 68°, 80°, 90°, 100°, 110°, 112°, 115°, 123°, 125°, 100°, 80°, 68°. Record total Wf at each point.

Limits: Difference between Wft readings at 112, 115, & 123 shall be no greater than 600 PPH.

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Amendment 3

1. Add paragraph *6.1.1 to read:

   *6.1.1 "Sheet test rig off and remove the T.O.P.V. adjustment access cover. Mount a dial indicator (.250 inch stroke minimum) thru this access hole to contact the T.O.P.V. end. Rotate the power lever from 0 to 125°. Dial indicator should show a change in displacement of .166 minimum. At 67° PLA the dial indicator must show a displacement of .030 to .080 from the 0° PLA. Adjust the T.O.P.V. cam until this is obtained. Lock cam in place."

2. Change paragraph 6.2 to read:

   *6.2 Check to be sure that the power lever stops on the external stop plate. If it doesn't stop externally (at 125° end of rotation) adjust the T.O.P.V. cam but still keeping within displacement limits in 6.1.1. Lock cam. No further adjustments are to be made on this cam.

   Caution: Torque on adjusting screws to be 15-20 in-lb."

3. Change paragraph 6.3 to read:

   6.3 "Set PLA = Max, PB = 15 psia. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust the T.O.P.V. until the recirculation value closes and the Zone I SOV is open."

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Amendment 4

1. In paragraph 2.2, add section no. "13.0" to each line under the "retest" heading for both the reset and replace divisions.

2. Add paragraph 9.4 to read:

" *9.4 Record TT2 (°F) versus Tt2 displacement at Tt2 of -65°F, +200°F, +300°F, +500°F, and +750°F. Displacement must be within ± .015 of the nominal curve in HS1434, Appendix B."

3. Change paragraph *12.8.1.3 to read:

" *12.8.1.3 Remove recirculation line from the control and ~~check~~ recirculation valve leakage. Leakage from the recirculation port must not exceed 40 cc/min."

4. Change paragraph *12.8.2.1 to read:

" *12.8.2.1 Set PLA = 0°, Tt2 = +59°F, PB = 15 psia, bleeds closed with main and boost pumps operating. Remove Zone I outlet line. Leakage in Zone I must not exceed 30 dpm. Shut down main pump."

5. Change paragraph *12.8.2.2 to read:

" *12.8.2.2 Set PLA = 0°, Tt2 = +59°F, PB = 15 psia. Maintain boost pressure at 50 psig. Remove Zone I outlet line. Leakage must not exceed 30 dpm."

6. Change paragraph 12.11.1 to read:

" 12.11.1 The following items shall be run three times in the following sequence:

a) Fuel temperature at 100 ± 5°F.
b) Fuel temperature at 325-350°F.
*c) Fuel temperature at 100 ± 5°F
*d) Fuel temperature at 325-350°F
*e) Fuel temperature at 100 ± 5°F

All runs are to be made at room temperature ambient conditions."

7. Change paragraph 13 to read:

" *13. FINAL LEAKAGE CHECK "

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8. Change paragraph 13.1 to read:

"*13.1 The following sequence is to be used to make a final leakage check after running hot with all surfaces dry before starting this check. Hold at each condition for 1 minute before checking for leakage. Check leakage for 5 minutes at each setting. No external leakage is allowed. The term "no leakage" is defined in paragraph *12.8.1.1."

9. Add paragraph 13.1.1 to read:

"*13.1.1 Set PLA = 0°, CDP = 15, Tt2 = +59°F, B.C., and PB = 50 psia."

10. Add paragraph 13.1.2 to read:

"*13.1.2 Increase PLA = 70°."

11. Add paragraph 13.1.3 to read:

"*13.1.3 Increase PLA = max, increase CDP = 120 psia."

12. Add paragraph 13.1.4 to read:

"*13.1.4 Decrease CDP = 40 psia, B.C., increase Tt2 = +200°F."

13. Add paragraph 13.1.5 to read:

"*13.1.5 Decrease PLA = 0°, B.C., CDP = 40, decrease Tt2 = +59°F."

14. Change old paragraph number 13 to read "14."

15. Change old paragraph number 13.1 to read "14.1.".

16. Change old paragraph number *13.2 to read "*14.2."

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Amendment 5

Amend HS2097 as follows:

1. Change paragraph 1.3.1 to read:

1.3.1 "The following abbreviations are used in this specification:

1. Total Metered Fuel Flow ----------Wft
2. Absolute Burner Pressure ----------PB
3. Inlet Bulb Temperature (°F)----------Tt2
4. Power Lever Angle ----------PLA
5. Compressor Bleed Position ----------CBA
6. Throttle Valve Differential (PSIG) ----------T.V. ΔP
7. Pump Controller Differential (PSIG) ----------P.C. ΔP
8. Control Inlet Pressure (PSIG)----------Pin
9. Control Outlet Pressure (PSIG)----------Pout
10. Control Body Pressure (PSIG)----------PcB
11. Pressure in Recirculation Line (PSIG) ----------Pr
12. Clockwise ----------CW
13. Counterclockwise ----------CCW
14. Military PLA ----------Max (Wide Open Throti
15. Test Fluid Temperature (°F) ----------Ttf"

2. Delete paragraphs 1.3.2, 1.3.3, 1.3.4. Renumber paragraph 1.3.5 as 1.3.2.

3. Change paragraph 12.1.1 as follows:

12.1.1 "In second sentence add to values to be recorded 'Pin, Pout'. Add as sixth sentence, 'Record Ttf and PcB at initial Pb = 15 setting and at final Pb = 15 setting'"

4. Change paragraph 12.2.1 as follows:

12.2.1 "In second sentence add to values to be recorded 'Pout'. Add, as last sentence, 'Record Pin, PcB and Ttf at initial Pb = 15 setting and at final Pb = 15 setting.'"

5. Change paragraph 12.4.1 as follows:

12.4.1 "In second sentence add to values to be recorded 'Pout,' Add, as last sentence, 'Record Pin, Pout and Ttf at initial Pb = 15 setting and at final Pb = 160 setting.'"

6. Change paragraph 12.4.2 as follows:

12.4.2. "Add, as last sentence, 'Record Pin, Pout & Ttf at initial Pb = 15 setting and at final Pb = 150 setting.'"

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7. Change paragraph 12.4.3 as follows: "Add, as last sentence, 'For each setting of Tt2 record Pin, PcB and TtF at initial Pb = 15 setting and at final Pb = 120 setting.'"

8. Change paragraph 12.7.1 as follows:

12.7.1 "Add, as last sentence, 'Record Wft, Pin, Pout, Ttf and PcB for each Pb setting.'"

9. Change paragraph 12.9.1 as follows:

12.9.1 "In third sentence add to values to be recorded 'Pout'. Add, as last sentence, 'Record Pin, Ttf and PcB at initial PLA = 68° setting and at final PLA = 68° setting.'"

10. Change paragraph 12.11.1.1 as follows:

12.11.1.1 "In second sentence add to values to be recorded 'Pout.' Add, as last sentence 'Record Pin, Ttf and PcB at initial CDP = 20 setting and at final CDP = 120 setting.'"

11. Change paragraph 12.11.1.2 as follows:

12.11.12 "In second sentence add to values to be recorded 'Pout'. Add, as last sentence, 'Record Pin, Ttf and PcB at initial CDP = 20 setting and at final CDP = 20 setting.'"

1.0 GENERAL INFORMATION

1.1 Scope

This specification covers the mothod for testing the model JFC51 Afterburner Fuel Control 576500.

1.2 Equipment Required

Flow bench with a boost pump capable of supplying 10-70 psig fuel pressure to the main pumps in a closed loop system of operation. Main pumps capable of supplying 65000 PPH at 1000 psig pump discharge pressure. Two metered flow meteres; Zone I and Zone 2. Zone 1 meter must be accurate to 0.5% in the 3000 PPH to 5000 PPH range and the Zone 2 meter must be accurate to 0.5% in the 1500-25000 PPH range. A recirculation line flowmeter accurate to 1.0% in the 350-5000 PPH range. An internal leakage flowmeter accurate to 2,0% in the 350-3000 PPH Range. Pump discharge pressure to be controlled as a function of pump controller output thru a system of relief valves in pump discharge line.

1.2.1 Test fluid will be MIL 9073. Maintain control inlet and flow meter inlet at 100° ± 3° F except as specified for hot testing.

1.2.2 Pneumatic pressure source and two gages for simulating engine burner pressure capable of maintaining for a minimum period of 0.5 hour any pressure between 10 and 300 PSIA. One gage 0 to 50 psia accurate to ± 0.25 psia. One gage 0 to 300 psia accurate to ± 0.25 psia over a range of 50 to 300 psia.

1.2.3 Constant temperature baths capable of maintaining temperature of -65°, 0°, +59°, & +150° within ±5°F.

1.2.3.1 Temperature equipment to maintain temperature from +150°F to +950°F during Hot testing. Temperatures to be accurate within ±10°F.

1.2.4 Thermocouple and indicating unit with ±3°F accuracy for measuring temperatures between -65°F to +300° F and with ±5°F accuracy between +300°F and 950°F.

1.2.5 Temperature cam calibration follower and dial indicator 560000 ET-7.

1.2.6 Gages for taking the following measurements within the specified accuracy.

1. Control proof pressure 0-1500 psi with 1.0% accuracy of full scale reading.
2. Control inlet pressure (Pin): 0-1000 psi with 1.0% accuracy of full scale reading.

1.2.6 Continued:

3. Control output pressure (Pout): Two gages Zone 1 and Zone 2: 0-1000 psi with 1.0% accuracy of full scale reading.

4. Control body pressure (Pcb): 0-150 psi with 1.0% accuracy of full scale reading.

5. Total flow throttle valve differential gage (Δ PTFTV): 0-80 psi with .75% accuracy of full scale reading.

6. Peak flow throttle valve differential gage (Δ PPFTV): 0-150 psi with .75% accuracy of full scale reading.

7. Pump Controller differential gage: 0-200 psi with .75% accuracy of full scale reading.

8. Rig boost pressure (Prb): 0-100 psi with 1.0% of full scale reading.

9. Spare Gages:

   1. 0-600 psi with 0.5% accuracy of full scale reading.
   2. 0-800 psi with 1.0% accuracy of full scale reading.
   3. 0-1000 psi with 1.0% accuracy of full scale reading (2 gages).

1.2.7 Separate pressure source capable of supplying 200 pph at fuel pressures of 50-750 psig.

1.2.8 Provisions for testing the control at +350°F Fuel Temperature.

1.2.9 Back pressure schedule as indicated in Appendix E-1.

1.2.10 Sanborn Recorder.

1.2.11 X-Y coordinate plotter.

1.2.12 Angular position indicator to supply pump control output shaft position input to Sanborn recorder.

1.2.13 Preliminary Checks

1.2.13.1 The fuel control shall be assembled using the shimming procedures in HS 1594. The procedure is to act as a guide only, and may be varied as necessary to satisfy control calibration flow schedule requirements.

1.3 Test Requirements

1.3.1 The following readings shall be recorded at each calibration point.

1. Total Metered Fuel Flow - - - - - - - - - - - - - - - -Wft
2. Absolute Burner Pressure - - - - - - - - - - - - - - - PB
3. Inlet Bulb Temperature - - - - - - - - - - - - - - - -TT2
4. Power Lever Angle - - - - - - - - - - - - - - - - - —PLA
5. Compressor Bleed Position - - - - - - - - - - - - - - CBA
6. Throttle Valve Differential - - - - - - - - - - - - -T.V.Δ P
7. Pump Controller Differential - - - - - - - - - - - - P.C.Δ P

1.3.2 The following readings shall be recorded at the beginning and end of the variable input during calibration.

1. Control Inlet Pressure - - - - - - - - - - -PSIG- - - - - Pin
2. Control Outlet Pressure - - - - - - - - - -PSIG - - - - -Pout
3. Test Fluid Temperature - - - - - - - - - - -°F
4. Control Body Pressure - - - - - - - - - - -PSIG- - - - -Pcb

1.3.3 The following readings shall be recorded when noted:

1. Zone 1 Fuel Flow - Wf1
2. Zone 2 Fuel Flow - Wf2
3. Peak Fuel Flow - Wfp
4. Arming Signal - PSIG
5. Transfer Point - Wf and PB
6. Pressure in recirculation line PR.

1.3.4 The following abbreviations, in addition to the foregoing are used in this specification:

1. Clockwise - CW
2. Counterclockwise - CCW
3. Military PLA - MIL (wide open throttle)

1.3.5 Accuracy of settings:

1. PB settings shall be held exact.
2. Tt2 settings shall be held to ±5°F
3. Wf shall be read exact.

2.0 INSPECTION REQUIREMENTS

2.1 The items marked with an asterisk (*) in this specification are inspection items and as such must be under inspection surveillance.

2.2 Retest Requirements: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings Listed under corresponding "Retest" must be retested and settings not yet tested must be completed.

Reset	Retest
PB Servo (8.0)	14.1.1, 14.2.1, 14.4.1, 14.4.2,
Temperature Servo (9.0)	14.1.1, 14.4.1, 14.4.2,
Total Flow T.V. (10.0)	14.1.1, 14.2.1, 14.4.1, 14.4.2,
Zone 2 Transfer (12.0)	14.5.1, 14.5.2
Power Lever (6.1)	6.2, 6.3

Replace	Retest
Servo Housing	8.0, 14.1.1, 14.2.1, 14.4.1, 14.4.2,
Temperature Servo	9.0, 14.1.1, 14.4.1, 14.4.2,
Transfer Housing	12.0, 14.5.1, 14.5.2
Zone 1 Outlet Housing	14.8.2.1, 14.8.2.2
Zone 2 Outlet Housing	14.6.1, 14.8.1.3, 14.8.2.1, 14.8.2.2
Pump Controller	7.1, 7.2.1, 7.2.2

2.3 No adjustments or changes in parts shall be permitted during the final, inspected, test of the control.

3.0 INSTALLATION INSTRUCTIONS

3.1 Install control [illegible] cable in a position similar to normal engine mounted position (Ref. P & W. layout 203579), connect Pump Discharge to Control Inlet both outlets must be connected to separate flowmeters. Recirculation and Internal Leakage lines must also be connected to separate flowmeters.

3.2 Install 80 psi differential gage across the total flow throttle valve, 150 psi across peak throttle valve, also install 200 psi differential gage across the total flow T.V. and inline regulator.

3.3 Install a separate fuel pressure source to the speed signal valve.

3.4 Make sure that there are no open fittings on control and the internal leakage line is not "dead headed."

3.5 The flowmeter density adjustments shall be set in accordance with actual density measurements during both ambient and hot fuel tests.

4.0 EXTERNAL LEAKAGE

4.1 With PLA at Max [illegible], set boost pump pressure to 60 ± 15 psig. There shall be no external leakage except:

a) No more than 10DPM from the PB drain.
b) No more than 30DPM from the Pump Controller Drain.

The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

5.0 PROOF PRESSURE TEST

5.1 With PLA at max., increase Wf to 10,000 ± 500 PPH. Close outlet valve until pin is 1500 ± 20 psi. Maintain this pressure for a time period not to exceed 1 minute. There shall be no external leakage. Open outlet valve. The term "no leakage" shall be applied as defined in paragraph 4.1.

6.0 POWER LEVER SEQUENCE

6.1 Increase power lever angle until a position is reached where the PL Servo Piston moves .001-.005. Lock PL in place and adjust protractor slip ring until it reads 67°. At this position adjust the stop plate until the hole in the stop plate lines up with the slot in the index ring. Be sure protractor slip ring and stop plate are locked in position.

CAUTION: Be sure PL servo piston is not hitting the min line stop (cover or screw in cover) when finding the .001 - .005 motion position. Check by turning PLS position adj. cw until servo moves at least .020.

6.2 Set PLA = Max, PB = 15. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust T.O.P.V. cam until the recirculation valve closes and the Zone I S.O.V. is open.

CAUTION: Torque on adjusting screws to be 15-20 in-lbs.

7.0 PUMP CONTROLLER CALIBRATION

7.1 Set PLA = max., PB = 18. Adjust spring pre-load on pilot valve until P1 - P3 is 100 ± 2 psi. Repeat at PB = 50 & 100 differential pressure must remain at 100 ± 5 psi.

7.2 DYNAMIC PERFORMANCE

*7.2.1 Integral Rate

7.2.1.1 Disconnect the pump contrd shaft from the stand output flow control. Install the fixtures necessary to make Sanborne traces of pump control output shaft angle and ΔP1-3. Set PLA at 120°, Tt2 at 59°F., PB at 100 psia, bleeds closed.

7.2.1.2 Adjust the stand output flow control to create a ΔP1-3 of 105 psi. When P.C. output shaft is near the center of it's stroke make a step change to decrease ΔP1-3 such that it is 5 to 9 psi below the P.C. setting. Obtain at least two sanborne recordings of this transient.

7.2.1.3 Put P.C. output shaft near the center of its stroke by varying ΔP1-3, then make a step change to increase ΔP1-3 such that is 5 to 9 psi above the P.C. setting. Get sanborne recordings of this transient.

7.2.1.4 The integration rate of the P.C. output shaft shall be between 0.1 and 0.3 degrees per psi error per second.

*7.2.2 Slew Rate Position

Disconnect Pump Controller Shaft from stand output flow control. Set PLA at 120°, Tt2 at 59°F., Pb at 100 PSIA, bleeds closed, adjust stand output flow to decrease ΔP (1-3) the amount necessary to cause the Pump Controller Arm to move at its "Slew Rate". ΔP (1-3) to get this slew rate shall be 18 to 22 psi below the Pump Controller setting. Shim under proportional piston spring to meet this requirement (Ref. Fig. 31, HS 1594). Maximum number of shims shall not exceed .130. If maximum shim thickness is exceeded, replace spring under the feedback piston with a lower dash numbered spring.

*7.2.3 Slew Rate

Disconnect pump controller shaft from stand output flow control. Set PLA at 120°, TT2 at 59°F, Pb at 100 psia, bleeds closed: adjust motor control to create ΔP (1-3) of 105 psi. Obtain a transient recording of ΔP (1-3) and pump controller output shaft angular position while making a rate change of 5 psi/sec (max) to decrease ΔP (1-3) 25 to 30 psi below the pump controller setting. The angular rate of the pump controller output shaft shall be at least 90° per second.

7.3 Set PLA = max. Increase PB until Wf = 25000 PPH. Adjust sensor for inline regulator until differential across total flow T.V. is 40 psi.

8.0 PB SERVO CALIBRATION

NOTE: Refer to Build-up Sheet for Dim. K L-7208-12. If Dim. K is Plus (+) add this amount to the below PB pressures.

8.1 Set PLA = 68°, increase PB to 30 ± K, bleeds closed. Adjust PB position adjustment until cam follower is in bottom of the detent on the PB cam.

NOTE: Bottom of detent is determined by change of motion on dial indicator. Bottom of detent is located at point where indicator reverses direction no more than (±.0001).

8.2 Increase PB to 215 ± K. Shim C.B.A. pushrod until cam follower is in bottom of high PB detent.

8.3 Repeat 8.1 and 8.2 until detents are set.

9.0 TEMPERATURE SERVO CALIBRATION

9.1 Set PB = 30 ± K, PLA = max, Tt2 = -65°F, bleeds closed. Adjust position spring on the Tt2 input lever until the cam calibration follower just starts to come out of the detent (± .0001).

9.2 Set PB = 30 ± K, PLA = Max. Tt2 = +950°F, bleeds closed. Adjust rate spring on the flapper until the cam calibration follower just starts to come out of the detent (±.0001).

9.3 Repeat items 9.1 and 9.2 until the detents are set.

10.0 TOTAL FLOW THROTTLE VALVE CALIBRATION

10.1 Set PB = 50, PLA = 68°, Tt2 = 59°F, bleeds closed. Record total flow T.V. displacement and total metered flow. Increase PB until disp. changes .100. (T.V. rate is 95.4 PPH/.001). Wf must change by 9540 PPH ± 100 PPH. Adjust inline sensor ΔP until set.

10.2 Bleeds closed, PLA = 0, Tt2 = +59°F, PB = 200. Recirculation flow must be 3000 PPH. Adjust minimum flow stop until this Wf is obtained.

10.3 Set bleeds closed, Tt2 = 65°F. Set PLA = max and read Wf at 50 & 90 PB. Then set PLA = min and read Wf at 75 & 150 PB. Plot these readings. A straight line drawing thru 50 & 90 on the max line and 75 & 150 on the the min line must intersect at 2.75 PSIA and -200 PPH. The actual intersection will be defined by finite values of Wf and PB (Wf and Pb error).

10.4 Bleeds closed, Tt2 = -65°F, PB = 30, PLA = max. Adjust T. V. multiplying lever hinge until Wf error is reduced to -200 pph.

10.5 If data lines determined in 10.3 do not intersect at -2.75 psia it will be necessary to reshim the T.V. multiplying lever hinge. Approx. .006 shims will change intercept 1 psi. Adding shims will move intercept to left (minus).

10.6 PLA = 67°, PB = 100, Tt2 = +59°F, bleeds closed. Adjust power lever servo pilot valve position until Wf = 7420 PPH.

*10.6.1 Set PLA = max, PB = 100, Tt2 = -65°F, bleeds closed. Record Wf. Increase Tt2 to +300°F and record Wf. Differential Wf between -65°F and +300°F must be 6700 ± 250 PPH. Adjust the Tt2 cam bias adjustment until this differential is obtained. Set PL rate adj. to center of its travel before setting Tt2 ball follower adj. screw.

10.7 Set PLA = max, PB = 100, Tt2 = -65°F, bleed closed. Adjust the power lever rate adjust (linkage bracket) until Wf = 43000 PPH. At this time check stroke of the power lever servo. Stroke must be .900 ± 100 for full power lever movement.

10.8 Recheck 10.6 and 10.7, as slight trimming adjustment may be necessary.

*10.8.1 Range of Remote Trim adjustment (PL Servo Rate):
Set PB = 100; Tt2 = +59°F; PLA = Max. Turn adjustment clockwise until it bottoms and record total Wf. Turn adjustment ccw until it bottoms and record total Wf. Limits: Adjustment range must be at least ±4% of Wf as calibrated. Range determined with this check must be recorded on the final data sheet. Note: Do not repeat this test during final calibration.

10.9 Set PB = 100, Tt2 = +59°F bleeds closed. At these conditions increase PLA until Wf is 13300 PPH. Adjust power lever stop to contact piston at this flow.

10.10 Bleeds closed, Tt2 = -65°F, Repeat 10.3. Adjust T.V. multiplying lever hinge until the intercept occurs at -2.75 psia and +5,900 PPH.

10.11 Set PB = 23 psia; PLA = 120°, Tt2 = +750°F; bleeds closed. Wf must be 12078-12698 pph. Trim to obtain this Wf by a P.L. servo position adjustment.

11.0 POWER LEVER TORQUE

11.1 Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

12.0 ZONE 2 MANIFOLD TRANSFER

12.1 Pressure in "Y" line must build up to within 10% of its final value within .25 seconds measured from the time it starts to increase. Select bleed size to meet this requirement.

12.2 Set PLA = 65°, PB = 50, Tt2 = +59°F, bleeds closed. Increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 14490-16010 pph. Note: Adjust the C.D.P. transfer power spring to set the correct rate.

12.2.1 If transfer position cannot be set by procedure of para. 12.2 it will be necessary to use the T.V. yoke adjustment. Clockwise adjustment lowers position.

12.3 Set PLA = 65°, PB = 20, Tt2 = +59°F bleeds closed. Increase PB = 100, increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 28975-32025. Note: Adjust the C.D.P. transfer power spring to set the correct rate. Adjust the T.V. transfer power spring to set the correct position.

12.4 Check retransfer (Zone 1 closes on decreasing PL) according to note in Appendix D-1.

13.0 PEAK THROTTLE VALVE RATE

13.1 Set PLA = 120°, PB = 50, Tt2 = +59°F bleeds closed. Record Wf in Zone 1. Increase PB to 150 and record Wf in Zone 1. Difference in Wf between 50 and 150 PB must be 25000-26000 PPH. Adjust peak valve sensor until this difference is obtained.

13.2 Plot peak line with bleeds closed. Intercept with fuel flow axis, at PB = 0 psia, should not be off more than 300 PPH in either direction. If intercept is off more than ± 300 PPH, reshim 3-D cam to correct error. (Wf error/28 = shims).

14.0 FINAL CALIBRATION

Note: *1. A body pressure of 50 ± 20 psig shall be maintained throughout final calibration.
*2. No adjustments or changes of parts shall be permitted during the final calibration.
*3. Prior to final calibration all external screws which affect calibration settings shall be lockwired.

14.1 MAX RATIO CALIBRATION - BLEED CLOSED

*14.1.1 Set PLA = 120°, Tt2 = +59°F bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. ΔP at the following PB pressures (Note: Approach PB pressures in increasing direction.) PB=15, 20, 40, 60, 75, 85, 100, 120, 145, 180, 145, 85, 40, 20 and 15psia. appendix A-1 for limits. Hysteresis must be within 3000 PPH of observed increasing value. Record return to Pump Inlet Flow at 20 & 180 psia. Do not overshoot when setting PB pressures.

*14.1.2 Set PLA = 120°, bleeds closed, PB = 100 psia, Tt2 less than 20°F. Increase Tt2 to 59°F, allow to stabilize for at least one minute and record fuel flow. Increase Tt2 to 150°F, hold for at least one minute, then reduce it to 59°F. Allow one or more minutes to stabilize and record fuel flow. Limits shall be as defined in appendix A-1 for PB = 100 psia.

14.2 MIN RATIO CALIBRATION - BLEEDS CLOSED

*14.2.1 Set PLA = 68°, Tt2 = +59°F, bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. ΔP at the following PB pressures: 15, 20, 40, 100, 180, 100, 40, and 15 psia. See appendix B-1 for limits. Hysteresis must be within the limits defined in appendix B-1. (Note: Do not overshoot when setting PB pressures.)

14.3 POWER LEVER SEQUENCE AND TRANSIENT

*14.3.1 Set PLA = 120°, Tt2 = +59°F, PB = 18, bleeds closed. Decrease PLA to 0° then slowly increase PLA. At 66° - 67° the recirculation valve must close at or after the time at which the Zone I manifold S.O.V. opens. Increase PLA to 120°. Slowly decrease PLA and record PLA at which S.O.V. closes. PLA must be within 65° - 67° when S.O.V. closes. Recirculation valve must open at or before the time at which the S.O.V. closes.

*14.3.2 Set arming signal at 0 to 50 psig, PLA = 0, Tt2 = 59°F, PB = 20 psia. Now advance the power lever to approximately 75°. Slowly increase arming signal pressure until the S.O.V. opens and record this pressure. Limits: The pressure must be between 30 and 110 psig above body pressure.

*14.3.3 Set Pb = 100 psia and Tt2 = +59°F. Change PLA from 67° to 120° within .8 to 1.2 seconds. The control fuel flow shall increase at a rate not to exceed 300 Wf/Pb ratios per second and complete 90% of the transient in 2 seconds or less.

*14.3.4 Set Pb = to 100 psia and Tt2 = to +59°F. Change PLA from 120° to 67° within .8 to 1.2 seconds. The control fuel flow shall complete 90% of the transient in 2 seconds or less.

*14.3.5 Set Pb = 100 psia and Tt2 = +59°F. Bleeds closed. Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

14.4 TEMPERATURE (Tt2) SENSING CALIBRATION - (See Appendix C-1 for Limits)
NOTE: All temperatures (Tt2) to be actual bulb temp. for final calibration.

*14.4.1 Set PLA = max, Tt2 = -65°F, bleeds closed. Record total metered Wf at the PB pressures noted in Appendix C-1. (Note: Approach PB pressures in increasing direction).

*14.4.2 Repeat item 14.4.1 at temperatures (Tt2) of +150°F, +300°F, +550°F, +750°F.

*14.4.3 The force required to open and close CBA pushrod shall not exceed [illegible] lbs, when body pressure is at 50 psig.

14.5 MANIFOLD TRANSFER AND PEAK SYSTEM CALIBRATION

14.5.1 In the following calibration record Zone I Fuel Flow (Wf1) at the manifold transfer points. A coordinate system plotter (X, Y) is required for this calibration. A plot of Wf1 vs PB shall be made for all calibration points. An indication must appear on the chart when the Zone II regulator opening pressure increases a minimum of 50 psi above control body pressure. This pressure increase indication must occur within the transfer limits defined in Appendix D-1. At each of the specified PB settings decrease PLA from max at a rate no faster than 2°/sec until retransfer occurs. Retransfer shall occur within the limits specified in Appendix D-1.

14.5.2 Set PLA = 68°, PB = 20, Tt2 = +59°F, bleeds closed. Increase PLA no faster than 2°/sec. record transfer and peak flow points at PB of 20, 30, 50, 100, 150 and 180. See Appendix D-1 for limits.

14.6.0 RECIRCULATION CALIBRATION

*14.6.1 Set PLA = 0°, PB =100 psia, Tt2 = +59°F, bleeds closed. Metered WF must be 2850 - 3150 pph. Record control inlet pressure and control body pressure. Control inlet pressure must be within 80-200 psi above control body pressure.

14.7.0 REPEATABILITY CHECKS

* 14.7.1 Check repeatability in accordance with and in sequence indicated in Appendix F-1.

14.7.2 Re-run per paragraph 14.7.1 two additional times. Re-run paragraph 14.7-1 a total of 9 additional times only if requested by HS Engineering. Cycle bleeds open to bl[illegible] closed twice before starting each re-run.

14.8.0 LEAK CHECK

*14.8.1 With all instrumentation removed from control, set the PLA at 120°, set PB at 150 psia, Tt2 at +59°F bleeds closed.

*14.8.1.1 Check external leakage. No leakage allowed except for overboard drain and PB drain.

The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

*14.8.1.2 Check overboard drain leakage. Allowable leakage shll be no more than 10 dpm from the PB drain and 30 dpm from the pump controller drain.

*14.8.1.3 Remove recirculation line from the control and check recirculation valve leakage. Leakage from the recirculation port must not exceed 20 cc/min.

* 14.8.1.4 Pressurize overboard drain port on pump controller to 10 psig. The external leakage shall not be greater than 8 drops per minute per [illegible]

*14.8.2 Shut-Off Valve Leakage

Note: Allow ten [illegible] minutes for lines to drain before taking leakage reading.

*14.8.2.1 Set PLA = 0°, Tt2 = +59°F, PB = 15, bleeds closed, with main and boost pumps operating. Remove zone I and zone II outlet lines. Leakage in zone I and zone II must not exceed 10 dpm in either line. Shut down main pump.

*14.8.2.2 Set PLA = 0°, Tt2 = +59°F, PB = 15. Maintain Boost Pressure at 50 psig. Remove Zone I and Zone II outlet lines. Leakage must not exceed 20 dpm in either line.

14.9.0 Power Lever Cam Calibration Check

*14.9.1 Set PB of 100 PSIA; Tt2 = +59°F. Set, in sequence, power lever angles of 67°, 75°, 85°, 95°, 105°, 120°, 95°, 75°, 67°. Record total Wf at each point.

*14.10.0 The "K" dimension used in setting up the PB system position must be recorded on the final data log sheets.

14.11 HOT TEST REQUIREMENTS

14.11.1 The following items shall be run three times in the following sequence. First with fuel temperature at 100 ± 5°F, then with fuel temperature at 325 - 350°F, then with fuel temperature at 100 ± 5°F. All runs are to be made at room temperature ambient conditions.

*14.11.1.1 Set PLA at 120°, Tt2 at +300°F and bleeds closed. Record total flow at the following CDP pressures: 20, 60 & 100 PSIA. Note: Set CDP in the increasing pressure direction. See Appendix C-1 for limits.

*14.11.1.2 Set PLA at 120°, Tt2 at +750°F and bleeds closed. Record total flow at the following CDP pressures: 20, 30, 50, 100 hysteresis 50 and 30 psia. See Appendix C-1 for limits.

14.11.2 Repeat para. 14.11.2 to be sure speed signal valve is still operative.

15.0 PRESERVATION AND STORAGE

15.1 At conclusion of bench calibration, drain the calibrating fluid from the control and prepare the control for shipment in accordance with H. S. Spec. 380.

NOTE: Controls which have been insulated prior to running final bench calibration data must be heated in a ventilated oven at 250° ± 10°F for a period of 1 to 1½ hours after draining calibrating fluid from the control.

*15.2 The "dry" weight of the control shall be recorded on the installation inspection sheet.

APPENDIX A-1

PB	Conditions	Total Wf Limits
15		Record Wf Value Only
20	Tt2 = +59°F	11020 - 12180
40	Bleeds	15900 - 17600
60	Closed	20900 - 23200
75		24800 - 27400
85	PLA = 120°	28700 - 31800
100		34500 - 38200
120		40500 - 44800
145		42500 - 47000
180		51000 - 56500

APPENDIX B-1

PB	Conditions	Total Wf Limits
15		Record Wf Value Only
20	Tt2 = +59°F	7680 - 8520
40		9760 - 10800
100	Bleeds closed	16000- 17800
180	PLA = 68°	24200- 26800

APPENDIX C-1

Temperature Sensing Calibration

Tt2 = -65°F B.C.

PB	Total Wf Limits
15	Record Wf Value Only
20	11660 - 12900
60	24800 - 27400
100	38200 - 42200
150	52900 - 58500
180	53800 - 59500

Tt2 = +300°F B.C.

PB	Total Wf Limits
15	Record Wf Value Only
20	11180 - 12360
60	22200 - 24600
100	33000 - 36500
150	47100 - 52100
180	54200 - 59900

Tt2 = +150°F B.C.

PB	Total Wf Limits
15	Record Wf Value Only
20	10880 - 12040
60	21200 - 23400
100	32500 - 35900
150	44500 - 49300
180	52600 - 58200

Tt2 = +550°F B.C.

PB	Total Wf Limits
15	Record Wf Value Only
20	11100 - 12280
60	23900 - 26400
100	35800 - 39700
150	51300 - 56700
180	53800 - 59500

APPENDIX C-1 (cont.)

Tt2 = +750°F, B.C.

PB	Total Wf Limits
15	Record Wf Value Only
20	11220 - 11820
30	14260 - 15000
50	20300 - 22100
100	33800 - 37400
150	48000 - 53100
180	53800 - 59500

Note: Hysteresis Wf must be within specified limits.

APPENDIX D-1

PB	Transfer Wf B.C.	Peak Wf B.C.
20	5795 - 6405	4845 - 5255
30	8690 - 9610	7265 - 8035
50	14490 - 16010	12110 - 13390
100	28975 - 32025	24225 - 26775
150	43460 - 48040	36340 - 40160
180	52150 - 57650	43600 - 48200

Note: On decreasing PL excursion the control must retransfer within the following limits:

A) At PB values of 50 psia or less retransfer must occur at least 200 PPH below but no greater than 500 PPH below the increasing Transfer Fuel Flow.

B) At PB values above 50 psia retransfer must occur at least 200 PPH below but no greater than 10 ratio units below the increasing Transfer Fuel Flow.

APPENDIX E-1

Wf	Zone I Injection Manifold (psi)
3000	90 - 11[illegible]
6000	140 - 165
10000	195 - 22[illegible]
20000	300 - 34[illegible]
30000	390 - 440
40000	460 - 52[illegible]

APPENDIX F-1

	(PSIA) PB	Conditions	Total PPH Wf Limits	PPH Peak Wf Limits
1)	60	(Tt2 = -65°F B.C.)	24800 - 27400	14535-16065
	150	PLA = 120°	52900 - 58500	36340-40160
2)	40	(Tt2 = -65°F B.C.)	9760 - 10800	
	180	PLA = 68°	24200 - 26800	
3)	30	Transfer per paragraph 14.5.2	8690 - 9610	
	150		43460-48040	
4)	20	(Tt2 = 150°F B.C.)	10880 - 12040	
	150	PLA = 120°	44500 - 49300	

1.0 GENERAL INFORMATION

1.1 Scope

This specification covers the method for testing the model JFC51 Afterburner Fuel Control 568400.

1.2 Equipment Required

Flow bench with a boost pump capable of supplying 10-70 psig fuel pressure to the main pumps in a closed loop system of operation. Main pumps capable of supplying 65000 PPH at 1000 psig pump discharge pressure. Two metered flow meters; Zone 1 and Zone 2. Zone I meter must be accurate to 0.5% in the 3000 PPH to 50000 PPH range and the Zone 2 meter must be accurate to 0.5% in the 1500 25000 PPH range. A recirculation line flowmeter accurate to 1.0% in the 350 5000 PPH range. An internal leakage flowmeter accurate to 2.0% im the 350 3000 PPH range. Pump discharge pressure to be controlled as a function of pump controller output thru a system of relief valves in pump discharge line.

1.2.1 Test fluid will be Bayol "D" or P&WA 523. Maintain control inlet and flow meter inlet at 95° ± 5°F.

1.2.2 Pneumatic pressure source and two gages for simulating engine burner pressure capable of maintaining for a minimum period of 0.5 hour any pressure between 10 and 300 PSIA. One gage 0 to 50 psia accurate to ±0.1 psia, another gage 0 to 300 psia accurate to ±0.25 psia over a range of 50 to 300 psia.

1.2.3 Constant temperature baths capable of maintaining temperatures of -65°, 0°, +60°, and +150°.

1.2.3.1 Equipment to simulate temps. higher than 250°F. such as a pressure bellows fixture, dead weight fixture, or other suitable fixture to simulate actual Tt2 motor diaphragm assembly force input.

1.2.3.2 Temperature equipment to maintain temps. from -65°F. to +950°F. during hot testing.

1.2.4 Thermocouple and indicating unit with ±3°F. accuracy for measuring temperatures between -65°F. to +300°F. and ±5°F. accuracy between +300°F. and 950°F.

1.2.5 Temperature cam calibration follower and dial indicator 560000 ET-7.

1.2.6 Gages for taking the following measurements within the specified accuracy.

1. Control proof pressure: 0-1500 psi with 1.0% accuracy of full scale reading.

2. Control inlet pressure (Pin): 0-1000 psi with 1.0% accuracy of full scale reading.

3. Control outlet pressure (Pout): Two gages Zone I and Zone 2: 0-1000 psi with 1.0% accuracy of full scale reading.

1.2.6. Continued:

4. Control body pressure (Prb): 0-150 psi with 1.0% accuracy of full scale reading.

5. Total flow throttle valve differential gage (Δ PTFTV): 0-80 psi with .75% accuracy of full scale reading.

6. Peak flow throttle valve differential gage (Δ PPFTV): 0-80 psi with .75% accuracy of full scale rading.

7. Pump Controller differential gage: 0-200 psi with .75% accuracy of full scale reading.

8. Rig boost pressure (Prb): 0-100 psi with 1.0% of full scale reading.

9. Spare Gages:

   1. 0-600 psi with 0.5% accuracy of full scale reading.

   2. 0-800 psi with 1.0% accuracy of full scale reading.

   3. 0-1000 psi with 1.0% accuracy of full scale reading (2 gages)

1.2.7 Separate pressure source capable of supplying 200 PPH at fuel pressures of 50-750 psig.

1.2.8 Provisions for static testing the control at +450°F. Fuel Temperature.

1.2.9 Back pressure schedule as indicated in Appendix E-1.

1.2.10 Equipment to apply A 45-50 in.# CCW torque to the pump control shaft.

1.2.11 Preliminary checks

1.2.11.1 The fuel control shall be assembled using the shimming procedures in Appendix F of this specification. This procedure is to act as a guide only and may be varied as necessary to satisfy control calibration flow schedule requirements.

1.2.11.2 All valves must be stroked in their mating bores through at least 100 cycles according to the stroke requirements listed in Appendix G. During cycling, valve outside diameter and mating bore surfaces are to be lubricated withDominion A Spindle Oil obtainable from Atlantic Refining Co., 1351 Main Street, East Hartford, Connecticut, or its equivalent.

Note: One cycle consists of moving the valve from its original position through the desired stroke, and then returning the valve to the original position.

Caution: During cycling, valve should not strike bottom of bore nor be withdrawn from its mating bore in a manner that would damage valve sharp edges.

1.3 Test Requirements

1.3.1 The following readings shall be recorded at each calibration point.

1. Total Metered Fuel Flow- - - - - - - - - - - - - - Wft
2. Absolute Burner Pressure - - - - - - - - - - - - -PB
3. Inlet Bulb Temperature - - - - - - - - - - - - - - TT2
4. Power Lever Angle- - - - - - - - - - - - - - - - - PLA
5. Compressor Bleed Position - - - - - - - - - - - - CBA
6. Throttle Valve Differential - - - - - - - - - - - T.V.Δ P
7. Pump Controller Differential - - - - - - - - - - - P.C.Δ P

1.3.2 The following readings shall be recorded at the beginning and end of the variable input during calibration.

1. Control Inlet Pressure - - - - - - - - - PSIG - - - - - - Pin
2. Control Outlet Pressure - - - - - - - - PSIG - - - - - - Pout
3. Test Fluid Temperature - - - - - - - - - °F
4. Control Body Pressure - - - - - - - - - PSIG - - - - - - PcB

1.3.3 The following readings shall be recorded when noted:

1. Zone I Fuel Flow - Wf - Wf1
2. Zone 2 Fuel Flow - Wf - Wf2
3. Peak Fuel Flow - Wf - Wf_p
4. Arming Signal - PSIG
5. Transfer Point - PLA

1.3.4 The following abbreviations, in addition to the foregoing are used in this specification:

1. Clockwise - - - - - - - - - CW
2. Counterclockwise - - - - - CCW
3. Military PLA- - - - - - - - MIL (wide open throttle)
4. Idle PLA - - - - - - - - - 1° Above Shut-off

1.3.5 Accuracy of settings:

1. P_B settings shall be held exact.

2. Tt2 settings shall be held to ±5°F.

3. Wf shall be read exact.

2.0 INSPECTION REQUIREMENTS

2.1 The items marked with an asterisk (*) in this specification are inspection items and as such must be under inspection surveillance.

2.2 Retest hop[illegible] of settings listed under "Reset" are re-adjusted if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings listed under corresponding "Retest" must be retested and settings not yet tested must be completed.

Reset	Retest
By Speed (8.0)	14.1, 15.1, 16.1, 17.1, 19.1, 19.2, 19.3
Temperature Servo (9.0)	14.1, 19.1, 19.2, 19.3
Total Flow T.V. (12.0)	14.1, 15.1, 16.1, 17.1, 19.1, 19.2, 19.3
Zone 2 Transfer (12.0)	20.2, 20.3, 20.4
Power Lever (6.1)	18.1

Replace	Retest
Servo Housing	8.0, 14.1, 15.1, 16.1, 17.1, 19.1, 19.2, 19.3
Temperature Servo	9.0, 14.1, 19.1, 19.2, 19.3
Transfer Housing	12.0, 20.2, 20.3, 20.4
Zone 1 Outlet Housing	22.1, 22.2
Zone 2 Outlet Housing	22.1, 22.2, 23.1
Pump Controller	7.1

3.0 INSTALLATION INSTRUCTIONS

3.1 Install control on test stand, connect pump discharge to control inlet, all two outlets must be connected to separate flow meters. Recirculation and internal leakage lines must also be connected to separate flow meters.

3.2 Install 50 psi differential gages across the total flow throttle valve and the peak throttle valve, also install 200 psi differential gage across the total flow T.V. and inline regulator.

3.3 Install a separate fuel pressure source to the speed signal valve.

3.4 Make sure that there are no open fittings on control and the internal leakage line is not "dead headed".

3.5 Index protractor 560000 ET-1 so that the calibrating pin will slip thru the protractor, index ring and stop plate at 53° ± 15' below the max A/B stop.

3.5.1 Determine max A/B stop, decrease power lever 53° from this point. Insert index pin thru the protractor and index ring, if it doesn't engage hole in the stop plate, slip the stop plate until all three holes are lined up and the indexing pin can be inserted. Protractor must read 67° at this point. If necessary slip protractor face until 67° on protractor and scribe on dial are in line. Lock protractor and stop plate in place.

3.6 **The flowmeter density adjustments shall be set in accordance with actual density measurements during hot fuel tests.**

4.0 EXTERNAL LEAKAGE

*4.1 With PLA at max A/B, set boost pump pressure to 60 ± 5 psig. There must be no external leakage, and no more than 10 dpm from the P_B drain and 30 dpm from the pump controller drain.

5.0 PROOF PRESSURE TEST

*5.1 Set PLA; Max. increase Wf to 10,000 ± 500 PPH. Close down on outlet valve until Pin - 1500 ± 20 psi (do not hold over 1 minute at this pressure). Check for external leakage. No leakage allowable. Open outlet valve.

6.0 POWER LEVER SEQUENCE

6.1 Set PLA = Max. P_B = 15. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust T.O.P.V until the recirculation valve closes and the Zone I S.O.V. is open. Determine actuation by noting that when increasing the power lever the signal pressure to the recirculation valve is Pin to Pin - 20 psi, and the signal pressure to the Zone I S.O.V. is P_{Body} to P_{Body} + 20 psi.

7.0 PUMP CONTROLLER CALIBRATION

7.1 Set PLA = max. P_B = 15. Adjust spring pre-load on pilot valve until pressure differential between sensor inlet pressure is 75 ± 15 psi. Repeat at P_B = 50 & 100 differential pressure must remain at 75 ± 15 psi.

7.2 Set PLA = max. Increase P_B until Wf = 25000 PPH. Adjust sensor for inline regulator until differential across total flow T.V. is 40 psi.

8.0 P_B SERVO CALIBRATION

NOTE: Refer to Build-Up Sheet for Dim K L-7208-12. If Dim K is Plus (+) add this amount to the below P_B pressures.

8.1 Set PLA = Idle, increase P_B = 15 ± K, bleeds closed. Adjust peak throttle valve position adjustment until cam follower is in bottom of the detent on the P_B Cam.

Note: Bottom of detent is determined by change of motion on dial indicator. Bottom of detent is located at point where indicator reverses direction no more than (±.0001).

8.2 Increase P_B to 215 ± K. Shim C.B.A. pushrod until cam follower is in bottom of high P_B detent.

8.3 Repeat 8.1 and 8.2 until detents are set.

8.4 Set PLA = Idle, bleeds open. Vary P_B from 5 to 215. Locate low and high P_B detents. Difference between detents must be 168± 2 psi. Adjust CBA pushrod ball follower until this difference is obtained.

8.5 Set the bleeds in the closed position and determine that the Tt2 cam detents are still located at 15 ± K at 215 ± K psia.

8.6 Repeat items 8.1 thru 8.6 if required.

9.0 TEMPERATURE SERVO CALIBRATION

9.1 Set PB = 15 ± K, PLA = max, Tt2 = -65° F, bleeds closed. Adjust position spring on the Tt2 input lever until the cam calibration follower just starts to come out of the detent (± .0001).

9.2 Set PB = 15 ± K, PLA = max. Tt2 = +950°F, bleeds closed. Adjust rate spring on the flapper until the cam calibration follower just starts to come out of the detent (±.0001).

9.2.1 For calibration it is acceptable to simulate temperatures above 250°F per para. 1.2.4 of this specification.

9.3 Repeat items 9.1 and 9.2 until the detents are set.

10.0 TOTAL FLOW THROTTLE VALVE CALIBRATION

10.1 Set PB = 15, PLA = max. Tt2 = 60°F, bleeds closed. Record total flow T.V. displacement and total metered flow. Increase PB = 100. Record total flow T.V. Displacement and total metered flow T.V. rate is 90 PPH/.001.

10.2 Bleeds closed, PLA = 0, Tt2 = +60°F, PB = 20C. Recirculation flow must be 3000 PPH. Adjust minimum flow stop until this Wf is obtained.

10.3 Bleeds closed, Tt2 = +60°F. Run and plot Wf vs. PB for PLA at max. and idle for PB of 15, 30, 50, 75, 100, and 150. A straight line drawn thru 15 and 50 on the max. line and 100 and 150 on the min. line must intersect at -2 psia and -150 ppn. The actual intersection will be defined by finite values of Wf and PB. (Wf and PB error).

10.4 Bleeds closed, Tt2 = +60°F, PB = 15, PLA = max. Adjust T.V. multiplying lever hinge until Wf error is reduced to -150 ppn.

10.5 If data lines determined in 10,3 do not intersect at -2 psia it will be necessary to reshim the T.V. multiplying lever hinge. Approx. .006 shims will change intercept 1 psi. Adding shims will move intercept to right (plus).

10.5.1 Set PLA = Max, PB = 100, Tt2 = -65°F, bleeds closed. Record Wf. Increase Tt2 to + 550°F and record Wf. Differential Wf between - 65°F and + 550°F must be 9000 ± 250 PPH. Adjust the Tt2 cam bias adjustment until this differential is obtained.

10.6 PLA = idle, PB = 100, Tt2 = +60°F, bleeds closed. Adjust power lever servo pilot valve position until Wf = 7000 PPH. At these conditions turn the power lever servo stop C.W. until Wf starts to increase. Then turn CCW until Wf just stops decreasing.

10.7 Set PLA = Max., PB = 100, Tt2 = +60°F, bleeds closed. Adjust the power lever linkage bracket until Wf = 36000 PPH. At this time check stroke of the power lever servo. Stroke must be .900 ± .200 for full power lever movement.

10.8 Recheck 10.6 and 10.7, a slight trimming adjustment may be necessary.

11.0 POWER LEVER SERVO TRANSIENT (Optional to be run only if requested by H.S. Engineering.)

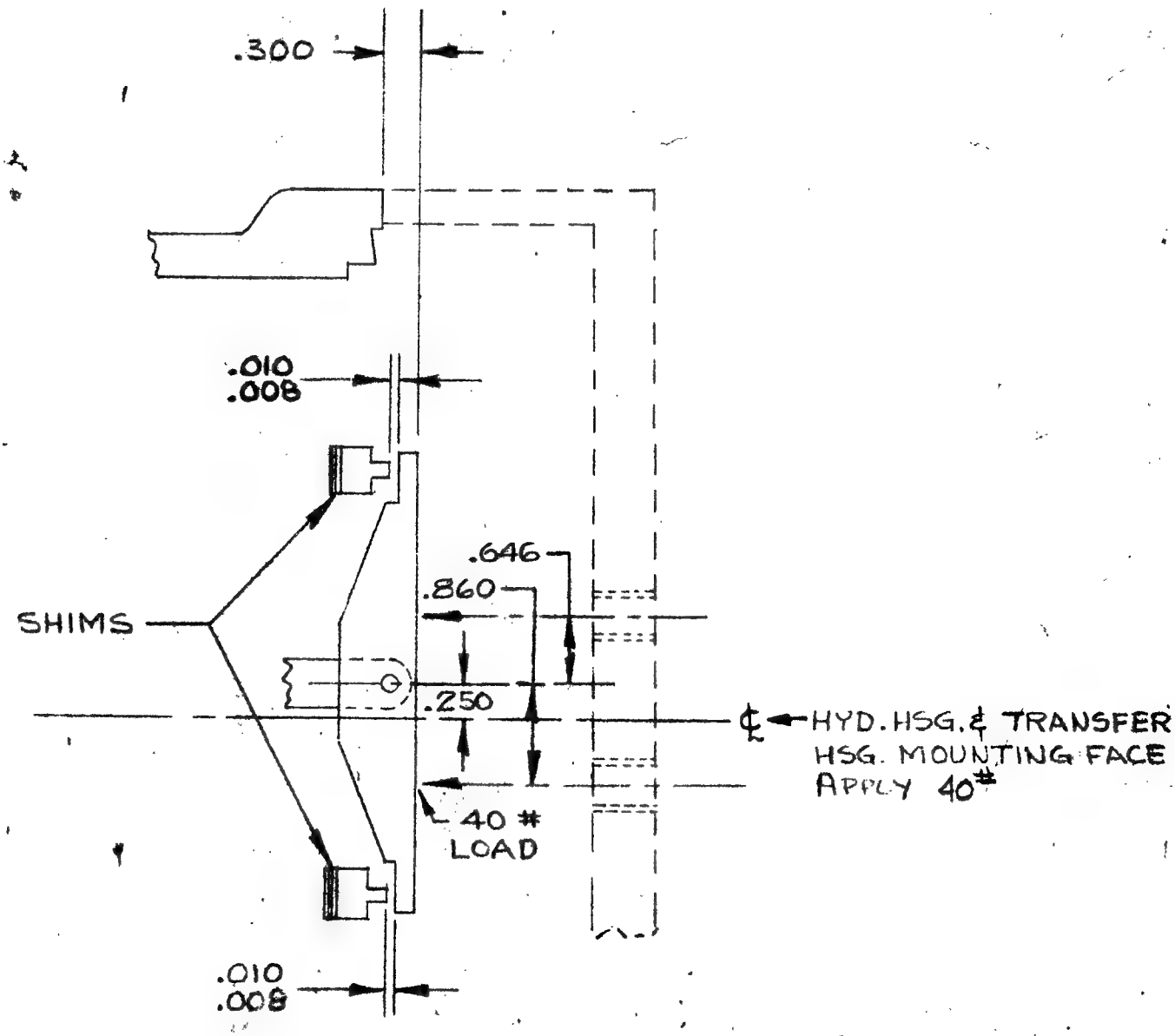
11.1 Shim inline regulator so full stroke of power lever servo is obtained in 4.75 ± .25 sec. Check affect of pressure and flow level on this transient.

11.2 Set PLA = Idle, PB = 100, Tt2 = +60°F, bleeds closed. Move power lever to max flow. Rate change must be 14400 PPH/sec. Maximum.

12.0 ZONE 2 MANIFOLD TRANSFER

12.1 Set PLA = Idle, PB = 60, Tt2 = +60°F, bleeds closed. Increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 16200-17200 PPH. Adjust the C.D.P. power spring to set the correct actuation point.

L-7208-23 ZONE II TRANSFER



SHIM UNDER NOZZLES TO OBTAIN .080-.010 GAP

FIGURE 10

12.2 Set PLA = Idle, PB = 15, Tt2 = +60°F, bleeds closed. Increase PB = 120, increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 32750 - 34250 PPH.

12.3 Set PLA = max, PB = 120, Tt2 = + 60°F, bleeds closed. Decrease PLA and determine point at which the Zone 2 manifold closes. Zone 2 manifold must close at 31750 - 34250 PPH.

13.0 PEAK THROTTLE VALVE RATE

13.1 Set PLA = max, PB = 50, Tt2 = +60°F bleeds closed. Record Wf in Zone 1. Increase PB to 150 and record Wf in Zone 1. Difference in Wf between 50 and 150 PB must be 22500-23500 PPH. Adjust peak valve sensor until this difference is obtained.

FINAL CALIBRATION

Note: A Torque of 45-50 in-# shall be applied to the pump control output lever throughout final calib.

14.0 MAX RATIO CALIBRATION - BLEEDS CLOSED

14.1 Set PLA = Max, Tt2 = +60°F, bleeds closed. Record total metered Wf, peak Wf, T.V. Δ P and P.C. Δ P at the following P_B pressures. (Note: Approach 15 psia in the increasing P_B direction in all cases unless otherwise noted). PB = 15, 20, 30, 40, 50, 75, 100, 115, 150, 200, 220, 150, 100, 50 and 15 psia. See Appendix A-1 for limits. Hysteresis must be within 4% of increasing Wf. Record return to pump inlet flow at 15 and 220 psia.

15.0 MIN RATIO CALIBRATION - BLEEDS CLOSED

*15.1 Set PLA = idle, Tt2 = +60°F, bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. Δ P at the following PB pressures; 15, 30, 50, 100, 150, 200, 220, 100, and 30 PSIA. See appendix A-2 for limits. Hysteresis must be within 4% of increasing Wf. See Note in Para. 14.1.

16.0 MAX RATIO CALIBRATION - BLEEDS OPEN

*16.1 Set PLA = max, Tt2 = +60°F, bleeds open. Record total metered Wf, Peak Wf, T.V. Δ P and P.C. Δ P at the PB pressures listed in 14.1. See appendix B-1. For Limits hysteresis must be within 5% of increasing Wf.

17.0 MIN RATIO CALIBRATION - BLEEDS OPEN

*17.1 Set PLA = Idle, Tt2 = 60°F, bleeds open. Record total metered Wf, T.V. ΔP, and P.C. Δ P at the PB pressures listed in 15.1. See appendix B-2. For limits hysteresis must be within 5% of increasing Wf.

18.0 POWER LEVER SEQUENCE AND TRANSIENT

*18.1 Set PLA = max, Tt2 = +60°F, PB = 15, bleeds closed. Apply 150 psig to the speed signal valve. Decrease PLA to 0° then slowly increase PLA. At 66-68° the recirculation valve must close and the zone I primary manifold S.O.V. must open. Increase PLA to 120°. Decrease pressure to speed signal valve to zero. Control must remain in the on position. Increase pressure to the speed signal valve to 150 PSIG, then slowly decrease PLA. Record PLA at which S.O.V. closes.

Note 18.2 and 18.3 to be run only if requested by H.S. Engineering.

18.2 Set PLA = Idle, PB = 100, Tt2 = +60°F, bleeds closed. Connect Sanborne recording equipment to the total flow element. Increase the power lever to max position. Rate of change of metered Wf must be 14400 PPH/sec. maximum. Repeat in the decreasing power lever direction.

18.3 Repeat item 18.2 at PB of 15, 50 and 150 psia. Wf rate change must not exceed 2120 PPH/sec at 15 psia, 7200 PPH/sec at 50 psia, and 21200 PPH/sec. at 150 psia.

19.0 TEMPERATURE (Tt2) SENSING CALIBRATION - (See Appendix C-1 for limits)

*19.1 Set PLA = max, Tt2 = -65°F, bleeds closed. Record total metered Wf at the following PB pressures: PB = 20, 30, 40, 50, 100, 150. See Note Para. 14.1.

*19.2 Repeat item 19.1 at temperatures (Tt2) of 0°F, +150°F, +550°F, +150°F, 0°F. Note: Temps. below 250°F to be actual, above can be simulated.

*19.3 Repeat item 19.1 at +550°F with bleeds open.

20.0 MANIFOLD TRANSFER SYSTEM CALIBRATION

20.1 In the following calibration record total metered Wf at the manifold transfer points.

*20.2 Set PLA = idle, PB = 30, Tt2 = +60°F bleeds closed. Increase PLA to max, record point listed in item 20.1.

*20.3 Repeat item 20.2 at PB of 60, 80, 100, 125, 150 and 190 psia. Run in decreasing power lever direction at 150 and 60 PB. See appendix D-1 for limits.

*20.4 Set bleeds in open position and repeat item 20.2 and 20.3. See appendix D-2 for limits.

21.0 MINIMUM OPERATING PRESSURE

*21.1 Set PLA = idle, PB = 15, Tt2 = +60°F, bleeds closed. Metered Wf must be 3150-3450 PPH. Record control inlet pressure and control body pressure. Control inlet pressure must be a minimum of 135 psi above control body pressure.

22.0 SHUT-OFF VALVE LEAKAGE

*22.1 Set PLA = 0°, Tt2 = +60°F, PB = 15, bleeds closed. Remove zone I and zone II outlet lines. Leakage in Zone I and Zone II must not exceed 10 dpm in either line. Re-connect outlet lines and shut down main and boost pumps.

*22.2 Set PLA = 0°, Tt2 = +60°F, PB = 15. Start Boost Pump only and maintain Boost Pressure at 50 psig. Remove Zone I and Zone II outlet lines. Leakage must not exceed 10 dpm in either line. Re-connect outlet lines. Turn on main pumps.

*23.0 RECIRCULATION VALVE LEAKAGE

*23.1 Set PLA = max, Tt2 = 60°F, PB = 15, bleeds closed. Remove the recirculation line. Leakage in the recirculation line must not exceed 20 cc/minute.

24.0 HOT TEST REQUIREMENTS

*24.1 The following items shall be run at room temperature ambient conditions and fuel temperatures of 150° - 175°F.

*24.2 Run items 14.1, 15.1, 20.2, and 20.3. Note: No external leakage is allowable.

*24.3 The following items shall be run under room temperature ambient conditions and fuel temperatures of 350° - 375°F.

*24.4 Run items 14.1, 15.1, 20.2 and 20.3. Note: No external leakage is allowable.

24.5 H.S. Engineering will determine acceptability of controls meeting Hot test requirements upon presentation of data.

25.0 PRESERVATION AND STORAGE

25.1 At conclusion of bench calibration, drain the calibrating fluid from the control and prepare the control for shipment in accordance with H.S.Spec 380.

APPENDIX A-1

PB	Conditions	Total Wf Limits	Peak Wf Limits
15	Tt2 = 60°F	5650-6250	3325-3675
20		7400-8200	4375-4825
30	Bleeds closed	10900-12100	6550-7250
40		14500-16000	8750-9650
50	PLA = Max.	18150-19950	10925-12075
75		26500-28500	16400-18100
100		34900-36900	22000-24000
115		42400-44000	25450-27450
150		52400-54400	33500-35500
200		59000-61000	41500-43500
220		59000-61000	41500-43500

APPENDIX A-2

PB	Conditions	Total Wf Limits
15	Tt2 = 60°F	2850-3150
30		2850-3150
50	Bleeds closed	3275-3625
100		6550-7250
150	PLA = Idle	9875-10875
200		13100-14500
220		14450-15950

APPENDIX B-1

PB	Conditions	Total Wf Limits	Peak Wf Limits
15	Tt2 = 60°F	6650-7500	3800-4300
20		8750-9850	5125-5775
30	Bleeds open	12875-14525	7700-8700
40		17050-19250	10250-11550
50	PLA = Max.	21400-23800	12825-14475
75		31500-33900	19300-21700
100		41500-43900	26100-28500
115		50400-52800	30200-32600
150		58800-61200	39800-42200
200		58800-61200	41300-43700
220		58800-61200	41300-43700

APPENDIX B-2

PB	Conditions	Total Wf Limits
15	Tt2 = 60°F	2825-3175
30		2825-3175
50	Bleeds open	3850-4350
100		7700-8700
150	PLA = Idle	11550-13050
200		15450-17450
220		17025-19175

APPENDIX C-1

Temperature Sensing Calibration

Tt2 = -65°F B.C.

PB	Total Wf Limits
20	8650-9750
30	12925-14575
40	17000-19200
50	21100-23500
100	42200-44600
150	58800-61200

Tt2 = 0°F. B.C.

PB	Total Wf Limits
20	7950-8950
30	11750-13250
40	15600-17600
50	19500-21900
100	38300-40700
150	57100-59500

Tt2 = +150°F. B.C.

PB	Total Wf Limits
20	7625-8575
30	11425-12875
40	15175-17125
50	18300-20700
100	35750-38150
150	53600-56000

Tt2 = +550°F. B.C.

PB	Total Wf Limits
20	6950-7850
30	10100-11300
40	13350-15050
50	16500-18600
100	33350-35750
150	50300-52700

Tt2 = +550°F. B.C.

PB	Total Wf Limits
20	8100-9300
30	11800-13600
40	15575-17825
50	19350-22150
100	39500-42300
150	58600-61400

Note: Hysteresis Wf must be within 5% of Wf in the increasing Tt2 direction

APPENDIX D-1

PB	Transfer Wf
30	7925-8775
60	15875-17525
80	21200-23200
100	26800-28800
125	33800-35800
150	40700-42700
190	43000-45000

Note: Hysteresis Wf must be within 2000 PPH of increasing Wf.

APPENDIX D-2

PB	Transfer Wf
30	9300-10500
60	18700-21100
80	25300-27700
100	31900-34300
125	40200-42600
150	42800-45200
190	42800-45200

APPENDIX E-1

Wf Zone 1	ΔP Injection Manifold (Psi)
3000	90-110
6000	140-165
10000	190-230
20000	295-345
30000	380-440
40000	460-520

Wf Zone 2	ΔP Injection Manifold (Psi)
2000	115-145
3000	135-165
5000	205-245
10000	315-365
150000	410-470

APPENDIX F

JFC-51 SHIMMING INSTRUCTIONS

Note: These shimming instructions are to be used for initial buildup. Final shim thickness and setting dimensions may be varied to meet the final flow calibration.

1. Power Lever Indexing (REF. L-7208-24; Et-1)

Determine Max. A/B stop, decrease power lever 53° from this point. Insert index pin through the hole in the protractor, index ring, and stop plate. Protractor must read 67° at this point. If necessary, slip the protractor face until it reads 67°. Lock protractor and stop plate in place.

2. Throttle Valve Roller Linkage (REF. L-7208-10)

2.1 Shim Bracket 560169 on peak valve piston such that "bellorank" lever 558961 has a 1:1 lever ratio.

2.2 Obtain dim. A (see Fig. 2) prior to installation of peak valve.

2.3 Shim thickness = A - B - 2.00

3. Throttle Valve Multiplying Lever Pivot (REF. L-7208-10)

3.1 Shim the multiplying lever pivot bracket 558958 such that the distance from the centerline of the pivot to the centerline of the rollers 568339 is 1.335 when the peak valve is at 215 psia ± K.

3.2 Set the multiplying lever at an angle of 30° by utilizing fixture 560000ET39 (See Fig. 1). Position the peak valve to 215 psia ± K. Zero out dial indicator. Install gage which locates rollers in respect to the centerline of the multiplying lever pivot. Adjust the peak valve position until the rollers are properly located. Determine amount and direction peak valve was moved. If adjusting screw was turned CCW (lower CDP) subtract this amount of shims from the multiplying lever pivot bracket. Add if C.W.

4. Throttle Valve Roller Guide (Ref. L-7208-10)

4.1 Shim position of throttle valve roller guide 558954 such that distance from bottom of roller carriage track to top of metering window in the throttle valve is 3.853±.002 (see Fig. 3).

5. Throttle Valve Position Adjustment (Ref. L-7208-10)

5.1 Assemble throttle valve less return springs in control. Position the throttle valve so that it is .010 from bottoming (minimum flow position).

5.2 With throttle valve located as in 5.1 limit the travel of the position adjustment rod 558963 by shimming under spacer 560213 with shims 513029 such that A = B. (See Fig. 9)

6. Power Lever Servo Output Lever (Ref. L-7208-10)

6.1 Install bracket 558966 on Servo Housing.

6.2 Obtain Dim. B, and C as shown on Fig. 4.

6.3 Shim between the Servo Housing and bracket 558966. Shim thickness = 1.080-(B+C).

7. Peak Throttle Valve T_{T_2} Cam (Ref. L-7208-12)

7.1 Determine the height to the centerline of the calibration cam follower A and to the centerline of control cam follower B from the parting line within .0005. (See Fig. 6)

7.2 Calculate Dim. K (to be used in control calibration)

Dim. K = Calib. Cam Follower H_t - Control Cam Follower H_t / .00615

Note: If Dim. K is minus, Dim. K must be subtracted from P_b settings specified in the control calibration.

7.3 Measure the following as shown on Fig. 6

C: Height of upper metering window edge in sleeve (558851) from parting line

D: Metering edge of piston (558849) to upper end of piston

(cont'd)

E: From shim shoulder to spherical radius on guide 558853.

F: From centerline of 15 psia detent on the cam 558860 to the shim shoulder on the cam.

7.4 Shim thickness = B - C + .092 - D - E - F.

7.5 Insert the cam shaft assembly in an arbor press in a vertical position. Apply a 30 lb. load to take the slop out of the pins. Measure the total shim thickness with a feeler gauge as shown in Fig. 6.

7.6 Install actual shim thickness between the 3-D cam and the cam shaft guide (558859).

7.7 Subtract the actual shim thickness from the total shim thickness and install these shims between the 3-D cam and the cam shaft collar (558857).

8. C.D.P. Sensor and Output Lever (Ref. L-7208-11)

8.1 Assemble the 560195 lever assembly and the 560194 housing. Using fixture 560000ET-33 locate the C.D.P. lever in the horizontal position and measure dimensions A and B as shown in Fig. 5.

8.2 Assemble the 560195 lever assembly into the servo housing. Hold the lever in the horizontal position as determined in 8.1 Shim the 558901 nozzles to give a .005 gap between each nozzle and the lever.

8.3 Assemble the motor bellows and adjust the screw so that the dimension from the bottom of pin 553137 to the bellows flange is B = .010 + gap between bellows flange and housing 560194.

8.4 Assemble evacuated bellows so that the dimension from the bottom of pin 553137 to bellows header is A = B + .045.

9. Temperature T_{2} Washout Link (Ref. L-7208-14)

9.1 Obtain the dimension A from the T_{t2} mounting face to the centerline of pin 69725-3036 in bracket 560013. (See Fig. 8).

9.2 With the power lever cam at its maximum radius obtain Dimension B Tt_2 housing mounting surface to the centerline of pin 69538A9-6 in lever 560024.

9.3 Shim between bracket 560013 and bracket 560028 with shims 560284.

9.4 Shim thickness = A - B.

10. Compressor Bleed Shift Linkage (L-7208-13)

10.1 With the C.D.P. lever in its horizontal position and multiplying lever 560141 parallel to it, determine dimensions (A), (B), (C), and (D) as shown on Figure 7. Shim under support bracket 560158 with shims 560157.

10.2 Shim thickness = C - (A + B) - (D + E)

11. Pressure Regulating Valve Sensor - Peak and Inline (Ref. L-7208-116)

11.1 With the flapper system assembled outside the sensor housing. Determine dimensions A, B, and C with the flapper closed as shown in Fig. 14.

11.2 Shim under pin-ball 558869 with shims 515298.

11.3 Shim thickness A-(B+C) + .015.

12. Manifold Transfer System (L-7208-23)

12.1 Install 560000 Et-23 across hydraulic housing with 70 lb. force directed to the balance bar, locating the force balance bar (560112) in a horizontal position. With the balance bar in a horizontal position shim both nozzles to a .008 - .010 gap. See Fig. 10.

12.2 Install 560000 Et-24 across the hydraulic housing. Maintain the force balance bar (5600112) in a horizontal position by installing .008 - .010 shim stock between nozzles and the force balance bar.

12.3 Utilizing 560000ET-24 locate the centerline of the C.D.P. rollers .3667002 from the centerline of pivot pin 69522-8-44 with the peak valve located at 15 psia ± K. With the rollers held in this position shim under bracket 560082 with shims 560098 until distance from the centerline of pin 69725-3G-14 on CDP rollers is .205±005 above the roller contact surface on the force balance bar.

12.4 Utilizing 560000ET-24 locate the centerline of the T.V. rollers .358±002 from the centerline of pivot pin 69522-8-44 with the throttle valve set for a .014 window opening. See Fig. 22. With the rollers held in this position shim under bracket 560093 with shims 560099 until distance from centerline of pin 69522-8-44 on the throttle valve rollers is .208±005 above the roller contact surface on the force balance bar.

12.5 Shim under bracket 560088 with shims 560097 so links 560087 and 560013 will not dis-engage under extreme travel conditions. (See Fig. 12)

12.6 Assemble transfer housing less power springs, adjusting screws and transfer valve. Install this assembly on fixture 560000 ET-31. Adjust position of lever 560069 and 560070 until it is parallel to the transfer housing mounting face. Obtain Dimension A. (See Fig. 19)

12.6.1 With transfer linkage assembled in hydraulic housing obtain the Dimension "B" from the top of the rollers to the hydraulic housing mounting face. (Fig. 11) Shim under bracket 560064 with shims 560096. Shim thickness = B - A.

13. Zone I Shut-Off Valve and Recirculation Valve

13.1 Obtain Dimension B on cap 558504 (See Fig. 18).

13.2 Assemble seat 539418, valve and sleeve assembly 560012 into the housing. Install chevrons and back-up rings and bottom chevrons with spacer 558905. With valve and seals held firmly against the shoulder obtain readings at 90° intervals on the retainer. The readings should not vary more than .004, if they do the assembly is not seated.

13.3 The average reading is dimension A.

13.4 Shim between spacer and back-up ring (See Fig. 18). Shim thickness = S-A-B-(.002 to .004).

13. Temperature Servo Piston Roller Position

13.1 Obtain dimension from the temperature servo piston cap mounting surface on the linkage housing to the centerline of peak throttle valve bore. (Dimension B. See Fig. 13).

13.2 Install the temperature servo piston and 560000 ET-21, and 560000ET-7. Position the servo piston until it is at -65°F as indicated by the cam follower (560000 ET-7). With the piston held in this position obtain Dimension X.

13.3 Position rollers on the servo piston such that Dim. A = B - X - .745

15. Temperature Servo

15.1 With levers 562050 and 562059 in line as shown on Fig. 15. Hold lever 560136 parallel to 562059 and shim under bracket 560138 until distance between 562059 and 560136 is .501 ± .001.

15.2 With levers held as in 16.1 shim nozzles 560129 for a .003 gap on each nozzle.

15.3 Shim under bellows assembly 574153 with shim 562054. Shim thickness $(X - E) + \left[(D + E) - A\right] \pm .001$. See Fig. 16 and 17.

15.4 Adjust stop screw 562055 until Dim. C - F - .300. See Fig. 17.

16. C.D.P. Sensor and Output Lever (Ref. L-7208-11)

16.1 Obtain dimension A. Centerline of C.D.P. bellows cavity to mounting surface for C.D.P. lever assembly. See Fig. 20.

16.2 Install approximately .050 shims 560187 in C.D.P. lever assembly.

16.3 Install the C.D.P. lever assembly in fixture 560000 ET-36. Load the lever on its pivots with screw item (1) and set the lever parallel to surface (3) with screw item (2).

16.4 Obtain dimension B. Centerline of pin (4) to mounting surface. See Fig. 21.

16.5 Shim lever with 560187 shims until A-B = 0.

17. Pump Control Piston (Ref. L-7208-112)

17.1 Shim under rack to position the pitch line on the centerline of the piston. See Fig. 23.

17.2 Obtain dim. A. O. D. of piston.

17.3 Position the lower piston rack until it is parallel to a referenced surface plate and obtain dim. B. using a 1150 dia. wire.

17.4 Shim under the rack with proper shims. Shim thickness = $(\frac{A}{2} + .068) - B \pm .001$

18. Zone II Shut-Off Valve and Peak Regulation Valve.

18.1 Obtain dimension B on cap 558904. (See Fig. 24).

18.2 Assemble sleeve 560008, packing 574177, sleeve 560005 and spacer 574355 into the housing. With assembly bottomed in the housing obtain dimension A.

18.3 Shim for use at the bottom of the bore is part #574353. Shim thickness = A-B-(.002 to .004).

18.4 Assemble backup ring #69587-A-58, chevron #69588-58 and retainer #69586-A-58 on sleeve 560005. (See Fig. 25).

18.5 With the assembly held firmly against the shoulder obtain readings at 90° intervals on the retainer. The readings should not vary more than .004; if they do the assembly is not seated.

18.6 The average reading is dimension E.

18.7 Shim for use at this point is #569669. Shim thickness = E-(.002 to .004).

18.8 Assemble backup ring #69587-A-60, chevron #69588-60, retainer #69586-A-60 on sleeve 560005.

18.9 With the assembly held firmly against the shoulder obtain readings at 90° intervals on the retainer. The readings should not vary more than .004; if they do the assembly is not seated.

18.10 The average reading is dimension C.

18.11 Obtain dimension D as shown on Fig. 25.

18.12 Shim for use at this point is #569669. Shim thickness = C-D-(.002 to .004).

APPENDIX G

PART NAME	LENGTH OF STROKE
1. Peak Throttle Valve	1.5 Min from bottomed position
2. Cam Shaft & Ends With Piston Ring	1.5 Min from top of bore
3. Pump Control	
a. Main Piston	1.4 Min from bottomed position
b. Intermediate Piston	.3 Min from top of housing
c. Pilot Valve	.4 Min from bottomed position
4. Throttle Operated Pilot Valve	
5. Transfer System	
a. Piston (In I&H Hsg.)	.5 Min from bottomed position
b. Transfer Valve	.5 Min from bottomed position
6. PL Servo Pilot Valve	.5 Min from stop-pin
7. PL Servo Piston (with Piston Rings)	.9 Min from bottomed position
8. Time Delay Valve	.3 Min from bottomed position
9. Speed Signal Valve (Upper & Lower)	.4 Min from bottomed position
10. PRV Sensor and Peak Sensor	.25 Min from top of sleeve
11. Inline PRV	.4 Min from bottomed position
12. Main T,V. (Install in Hsg. with Cover)	Stop to Stop
13. Zone I SOV	.4 Min from window end of sleeve
14. Zone II Valves	
a. Recirculation	.4 Min from window end of sleeve
b. PRV & SOV	.4 Min from window end of sleeve
c. Ref. Valve	.4 Min from top of sleeve
15. Tt2 Piston (With Piston Rings)	From Piston Ring Chamfer to Bottomed Position

L-7208-10 T.V. ROLLER LINKAGE

SHIMMING PROCEDURE

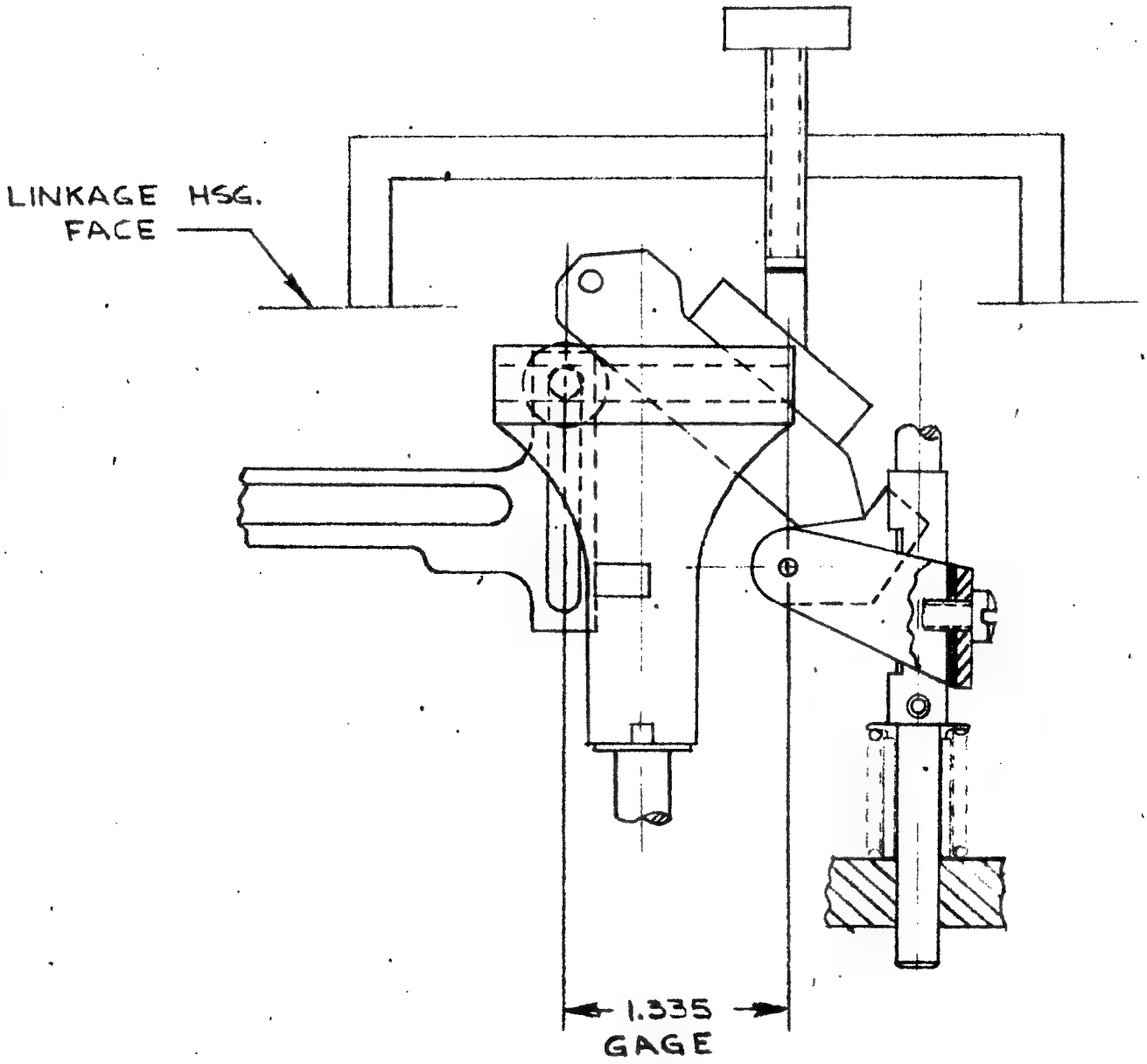
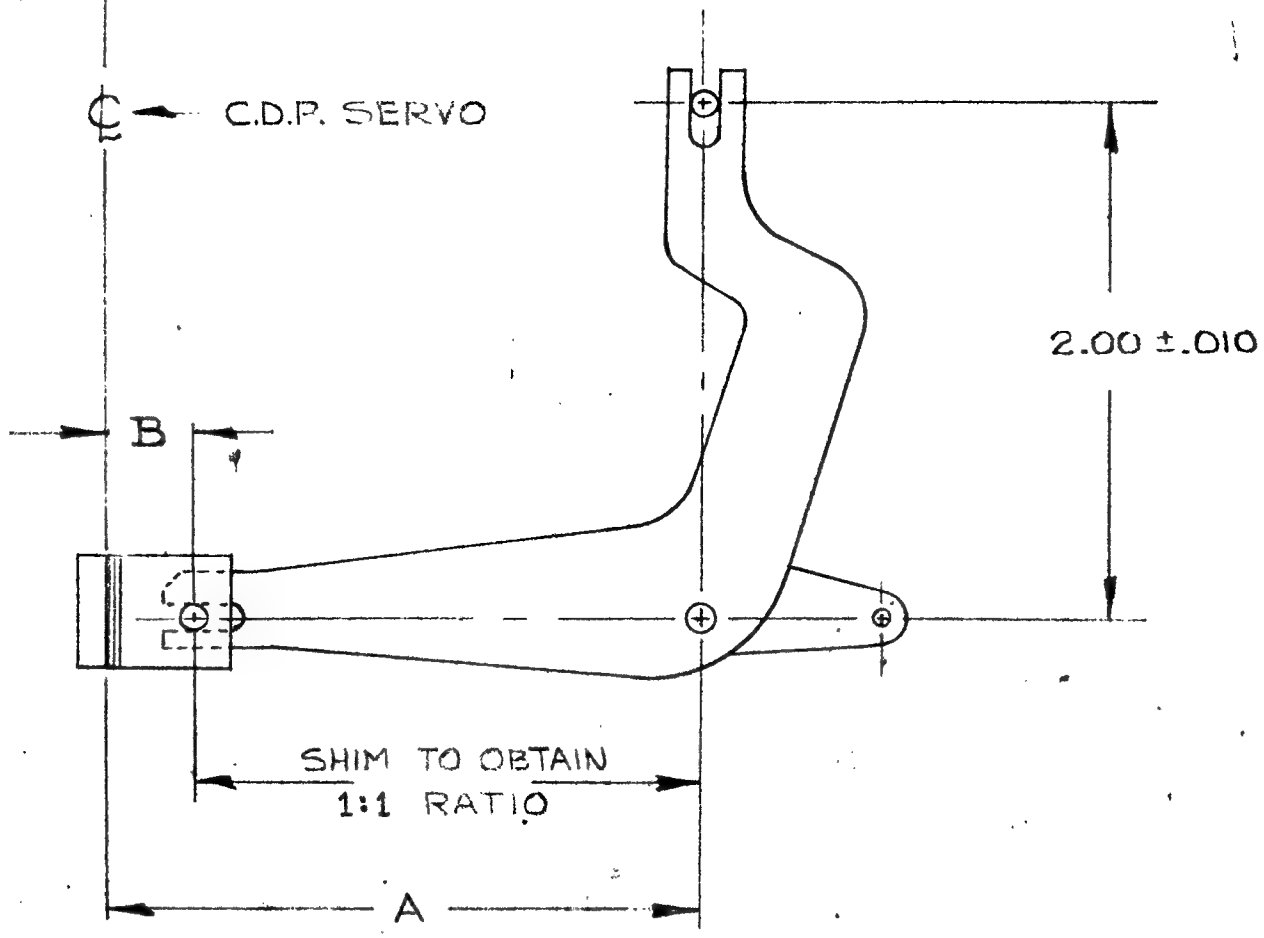


FIGURE 1

L-7208-10 T.V. ROLLER LINKAGE

SHIM TO OBTAIN 1:1 RATIO



SHIM THICKNESS = A - B - 2.00

USE 2.00" RATHER THAN MEASURING ACTUAL 2.00 ±.010 DIM., ERROR IN LEVER RATIO WILL BE INSIGNIFICANT, INSTEAD OF 1:1 RATIO WILL BE 1:1.01 .

FIGURE 2

FIGURE 3

L-7209-10 T.V. LINKAGE

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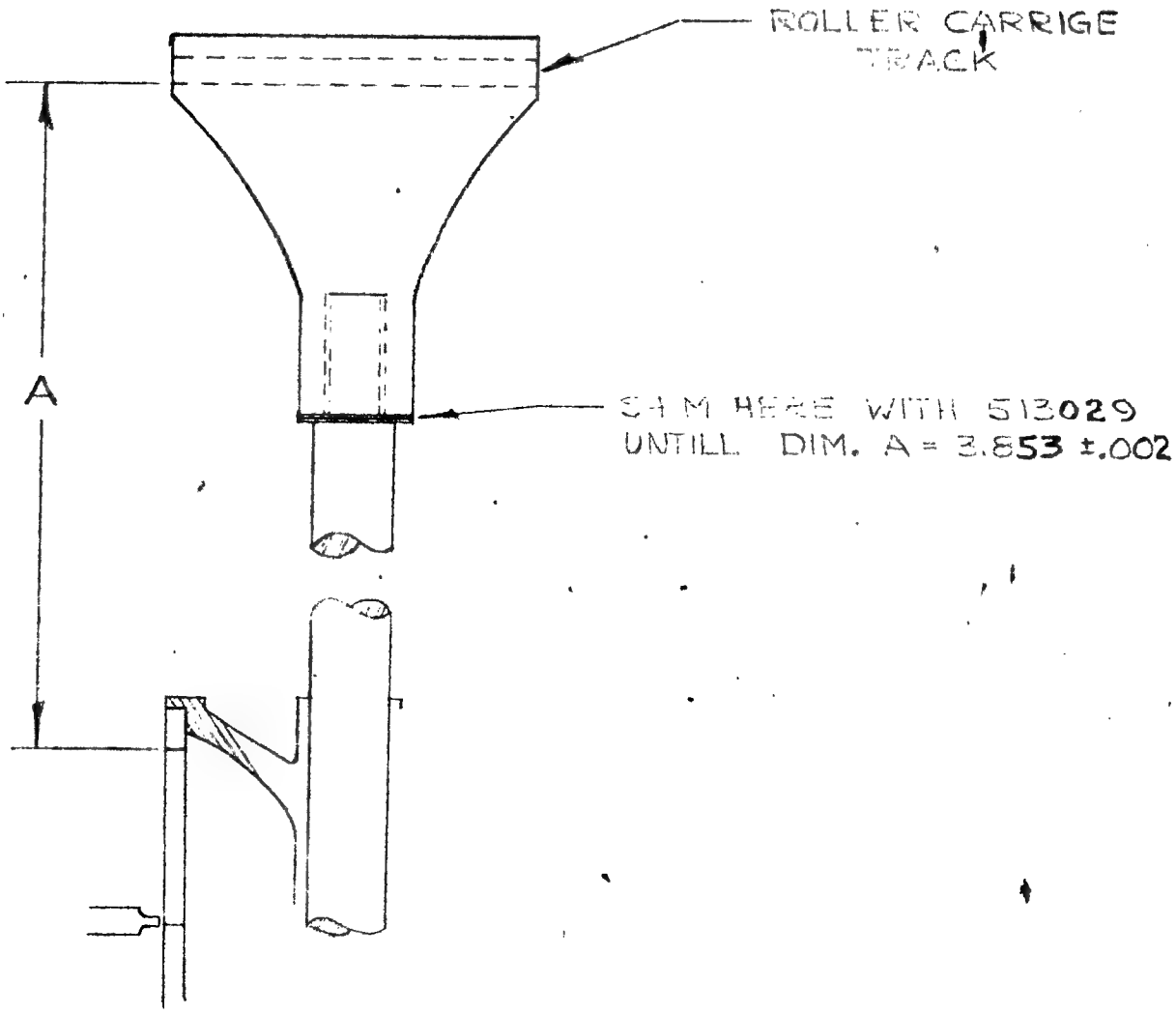
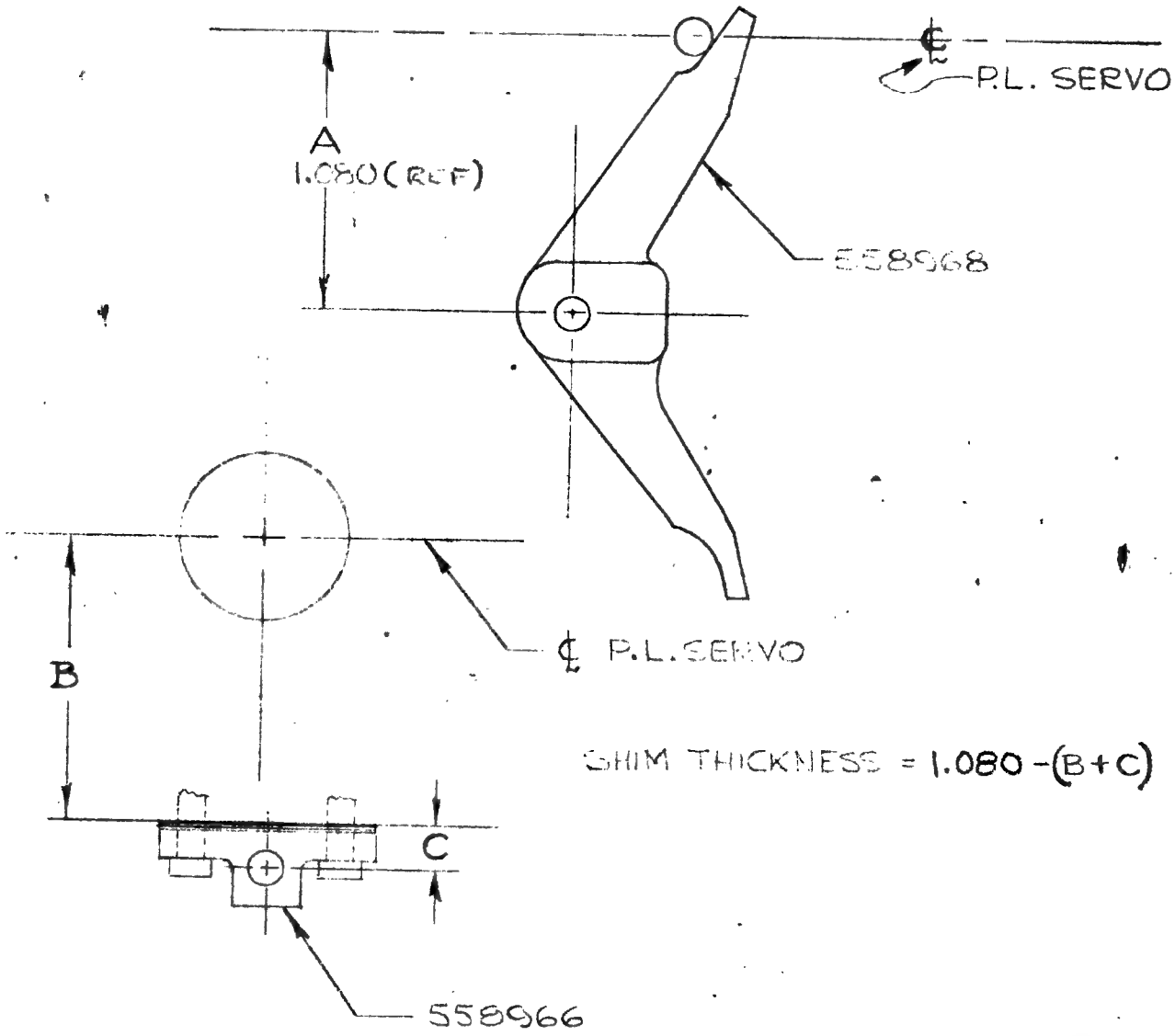


SHIM THICKNESS = A ± 3.853

FIGURE 3

L-7208-10 T.V. ROLLER LINKAGE

(SET CORRECT RATE BETWEEN P.L. SERVO & T.V. MULTIPLYING LEVER ANGULARITY.)



SHIM THICKNESS = 1.080 - (B+C)

FIGURE 4

L-7208-11 C.D.P. SENSOR

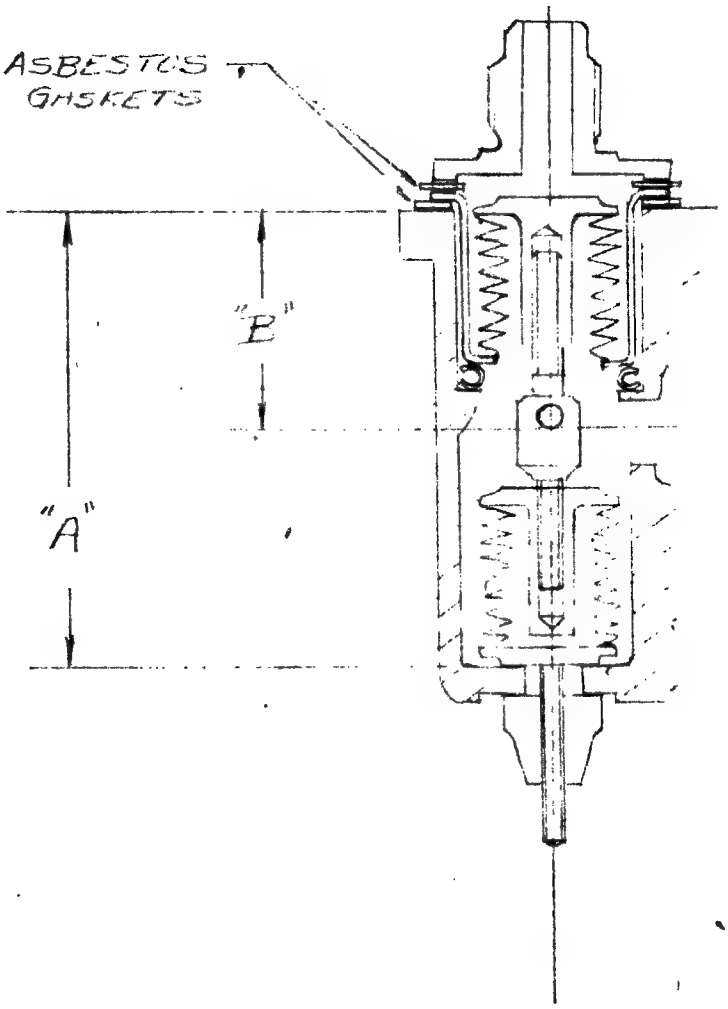
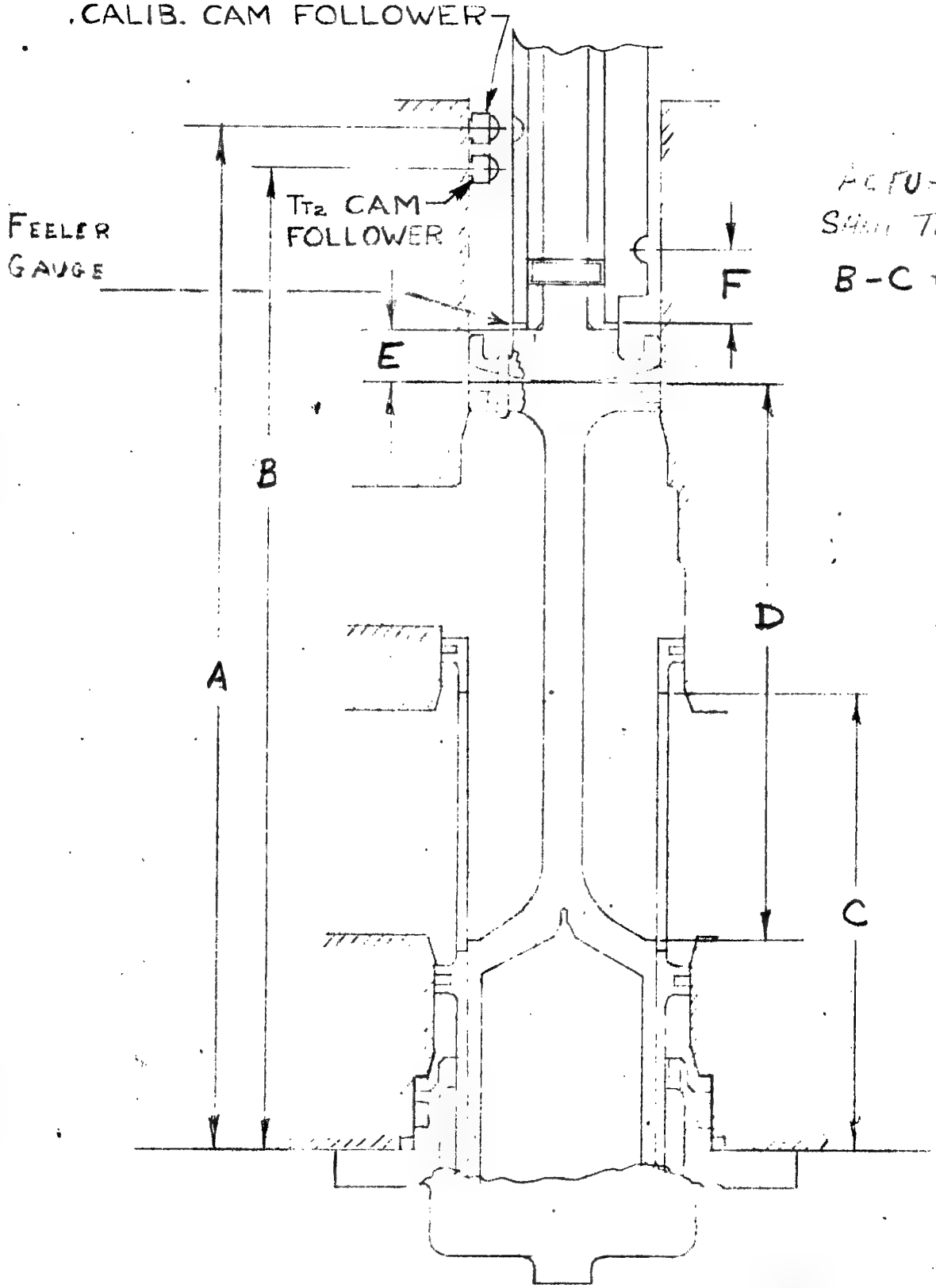


FIGURE 5

 RE 6



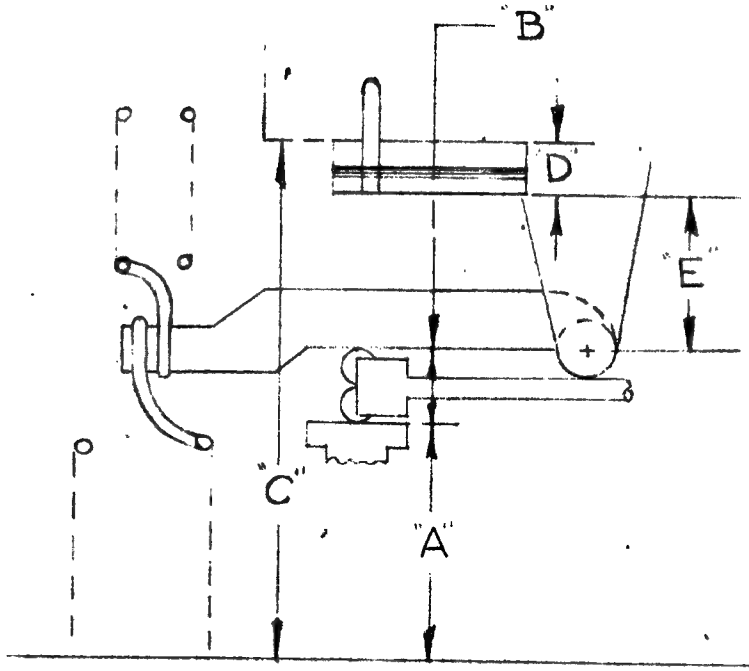
ACTUAL SHIM THICKNESS =

B-C+.092-D-E-F

FIGURE 6

L-7208-13 C.B.A. LINKAGE

MULTIPLYING LEVER & C.D.P. LEVER MUST BE PARALLEL

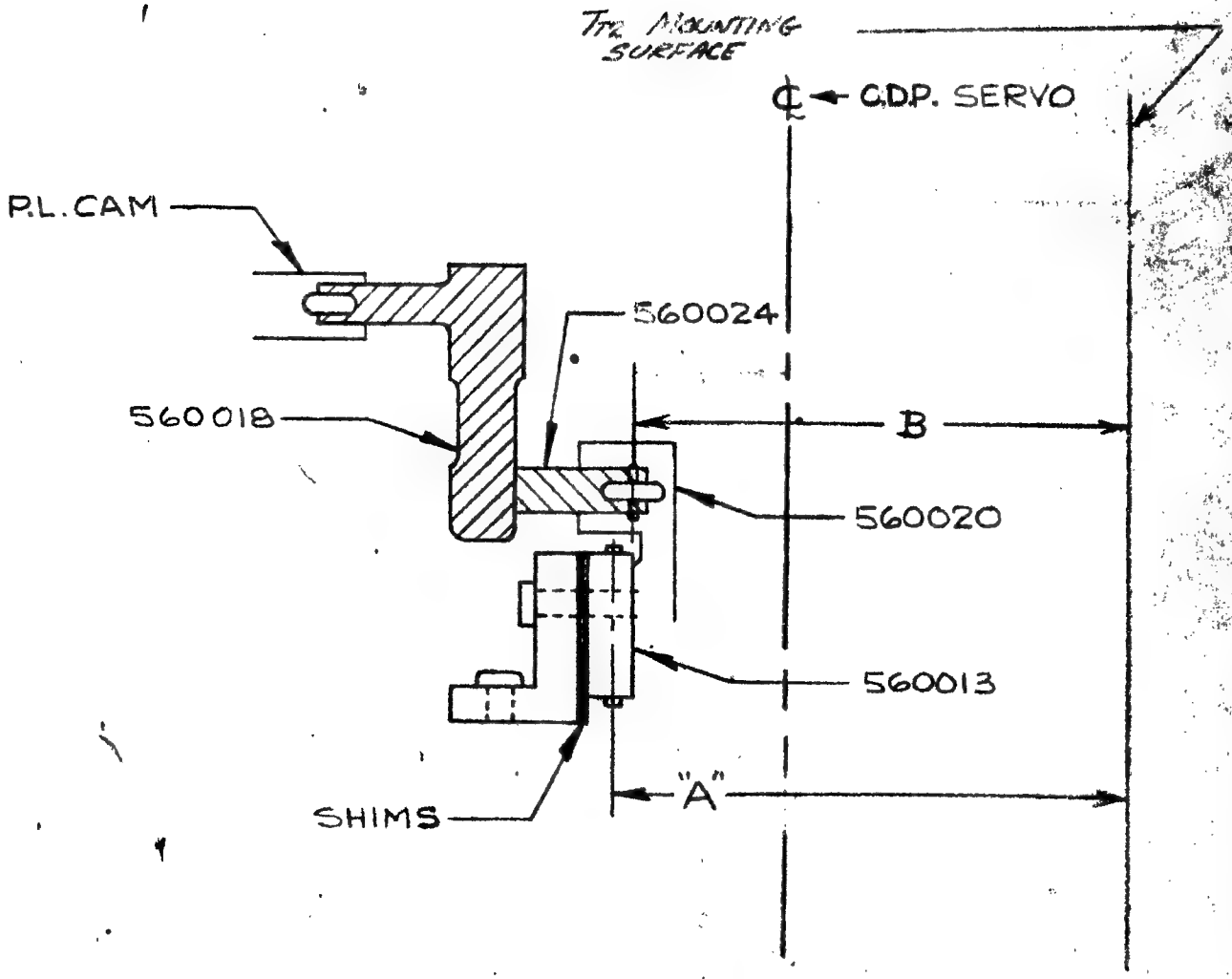


HSGS. 558808
558803

SHIM THICKNESS = C-(A+B)-(D+E)

FIGURE 7

L-7208-14 P.L. LINKAGE

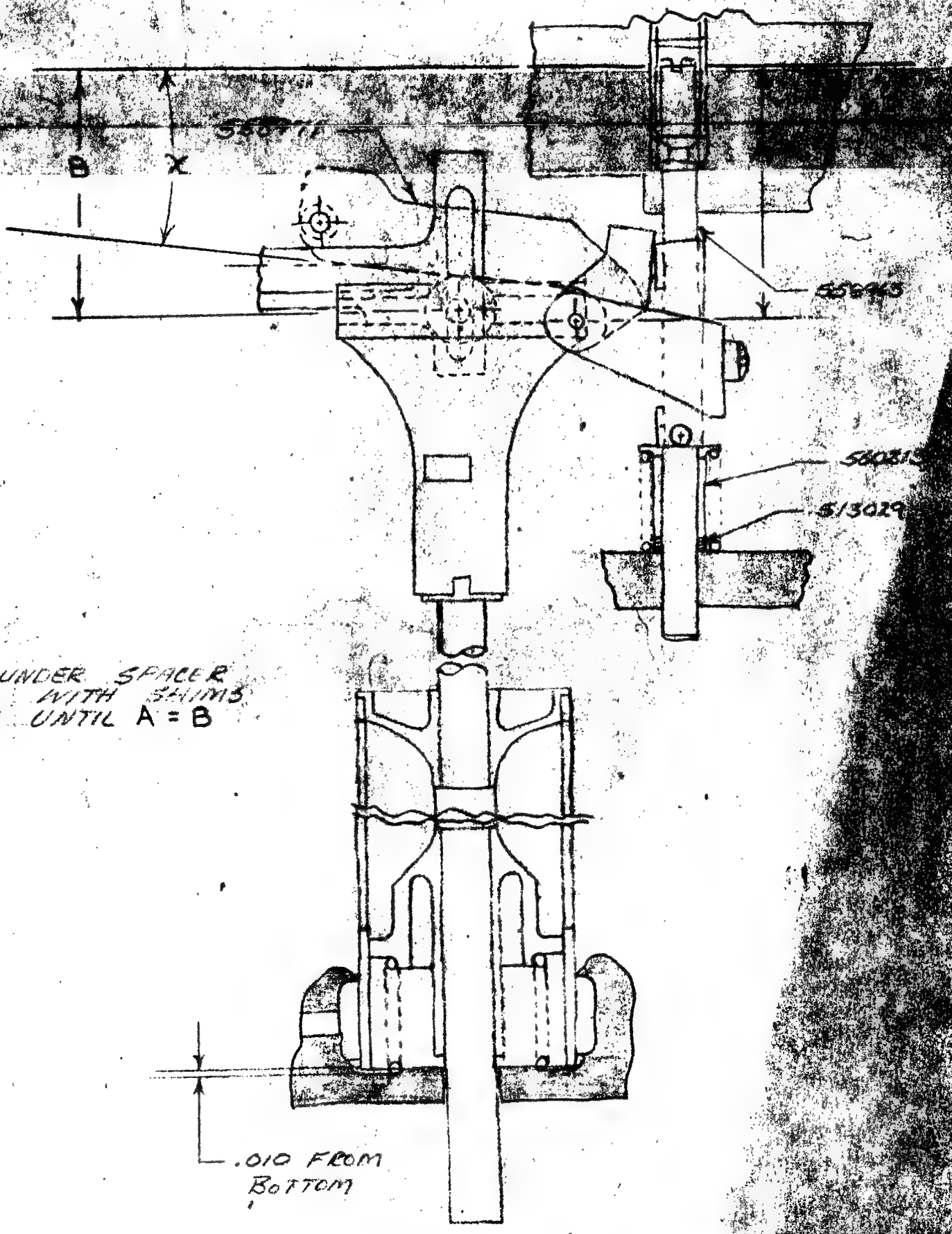


POWER LEVER CAM TO BE AT MAX. RAD. WHEN MEASURING DIM. "B"

SHIM THICKNESS = A-B

FIGURE 8

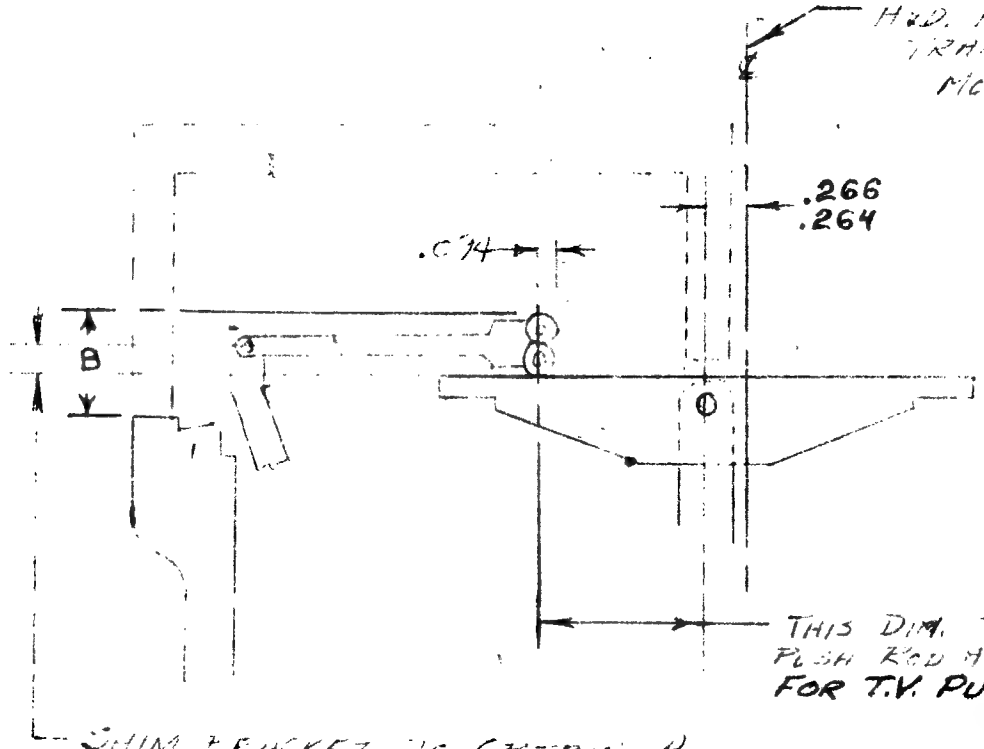
THROTTLE VALVE LINKAGE



SHIM UNDER SPACER 560213 WITH SHIMS 513029 UNTIL A = B

.010 FROM BOTTOM

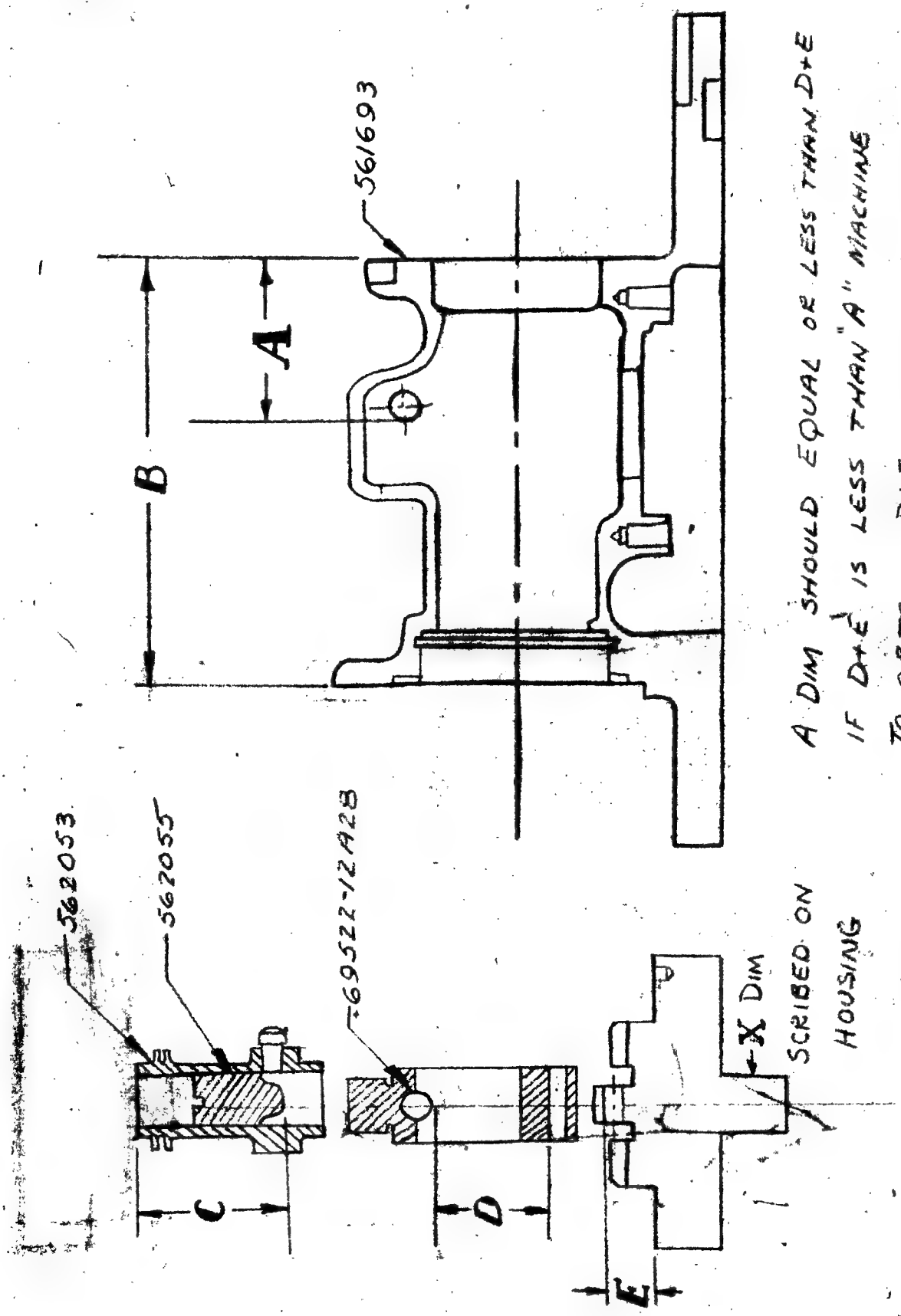
L 1208-23 ZONE II TRANSFER



NOTE:

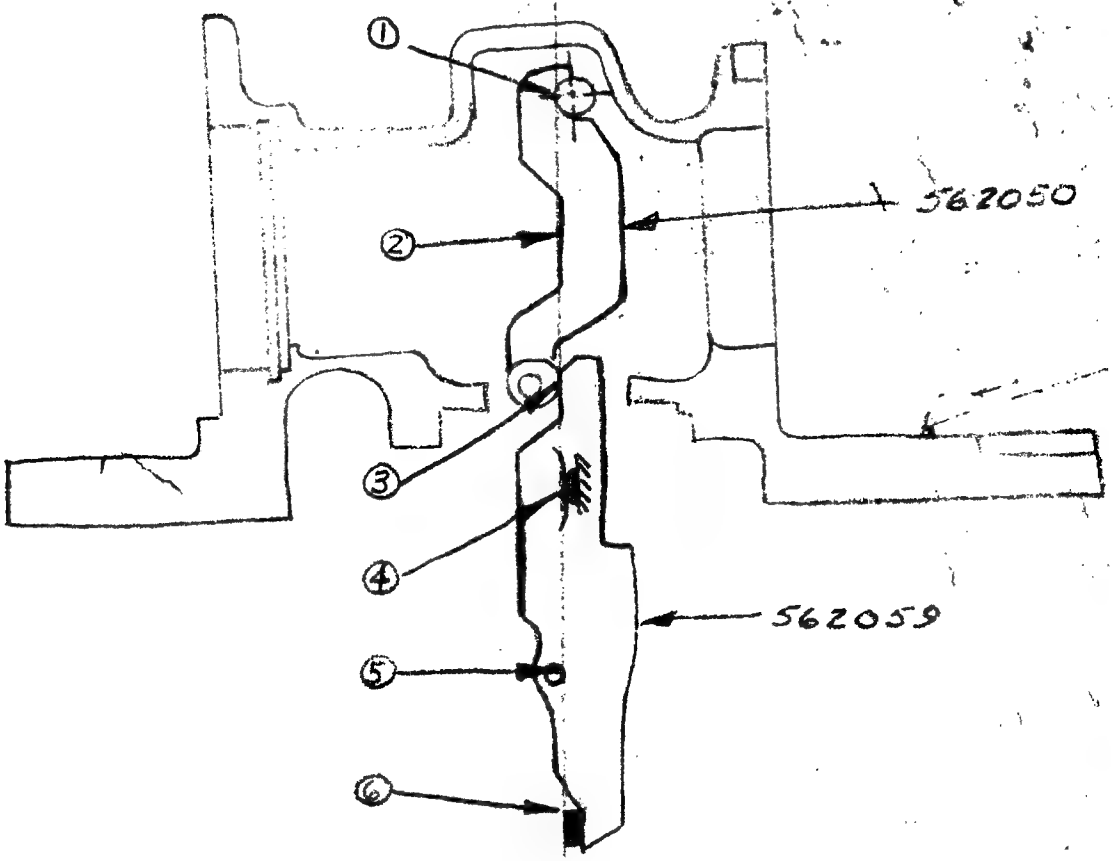
WHEN SETTING PIVOT TO ROLLER DIM. SET CDP SYSTEM SUCH THAT THE 3-D CMM BALL ROLLER IS IN THE CAM DETENT FOR CDP ROLLERS AND SET TV .014 OPEN WHEN SETTING T.V. ROLLERS.

TEMPERATURE SENSING SERVO



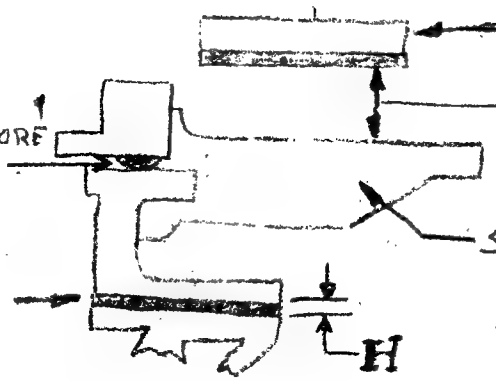
A DIM SHOULD EQUAL OR LESS THAN D+E
IF D+E IS LESS THAN "A" MACHINE
TO OBTAIN D+E TO BE .010-.015
GREATER THAN A. AFTER MACHINING
GET NEW A'S DIM FOR SHIMMING

TEMPERATURE SENSING SERVO



SET UP LEVERS 562050 AND 562059 TO BE IN LINE AT POINTS ①, ②, ③, ④, ⑤ AND ⑥

SURFACES MUST BE IN CONTACT BEFORE MEASUREMENTS ARE TAKEN.



WITH 562059 SET AT ABOVE POSITION ADD SHIM 558519 UNDER BRACKET 560136 SO THAT .501 DIM. IS OBTAINED WHEN LEVER 562059 & LEVER 562050 ARE PARALLEL

SHIM NOZZLES FOR .005 NULL GA

L-7208-28 T_{T2} SERVO

ADJUST POSITION OF ROLLERS SO THAT AT PISTON POSITION FOR -65°F DIM."A"="B"-"X"-.745
DIM."B" TO BE DETERMINED DURING INSP.

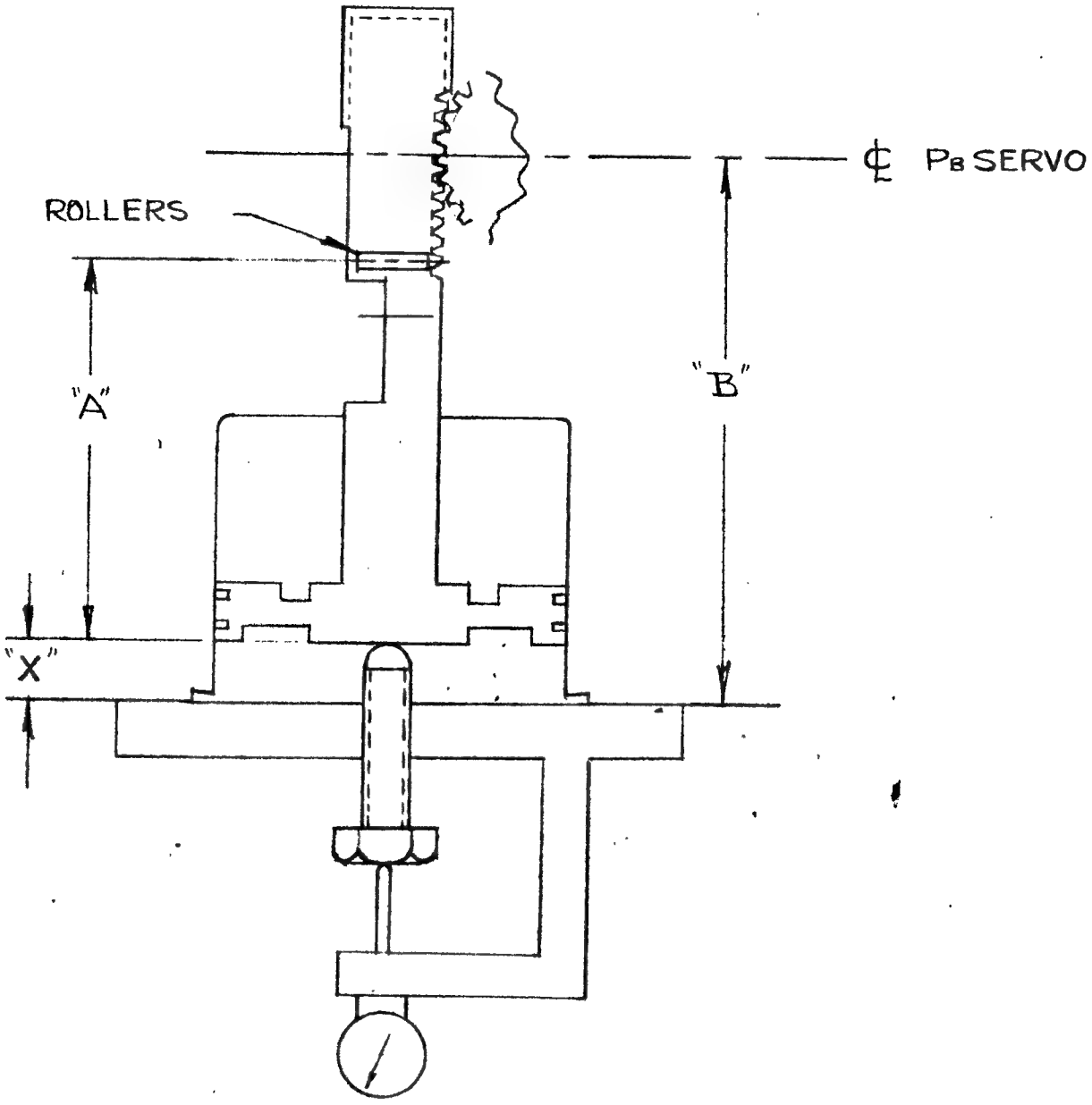
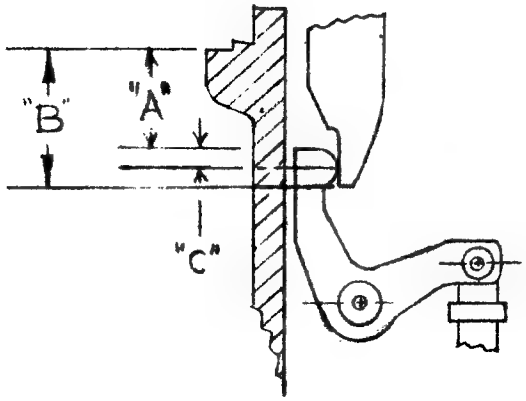


FIGURE 12

TRANSFER LINKAGE



SHIM UNTIL DIM "B" IS EQUAL TO OR GREATER THAN DIM. "A" + "C".

FIGURE 12.

SHIMMING PROCEDURE

FIG-14

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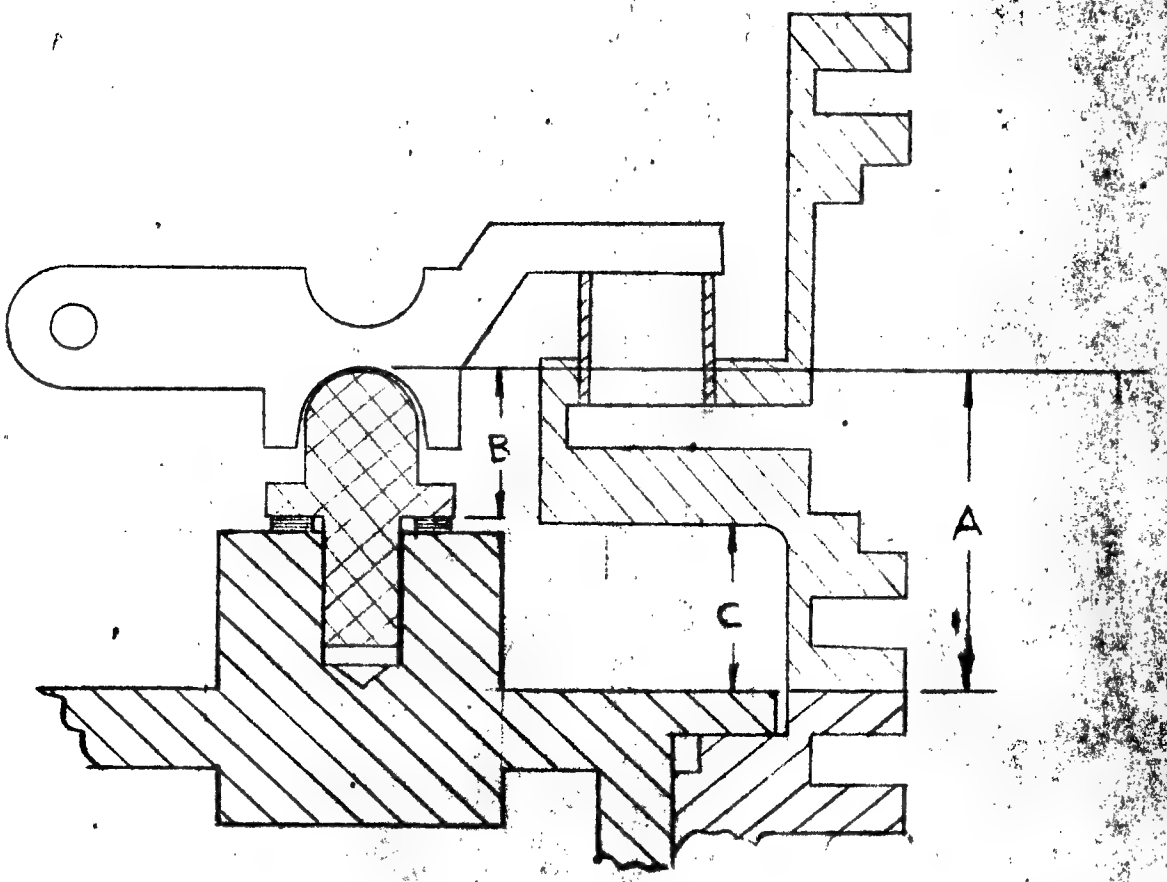
PRESS. REG. VALVE
SENSOR
CONTROL S/N _____

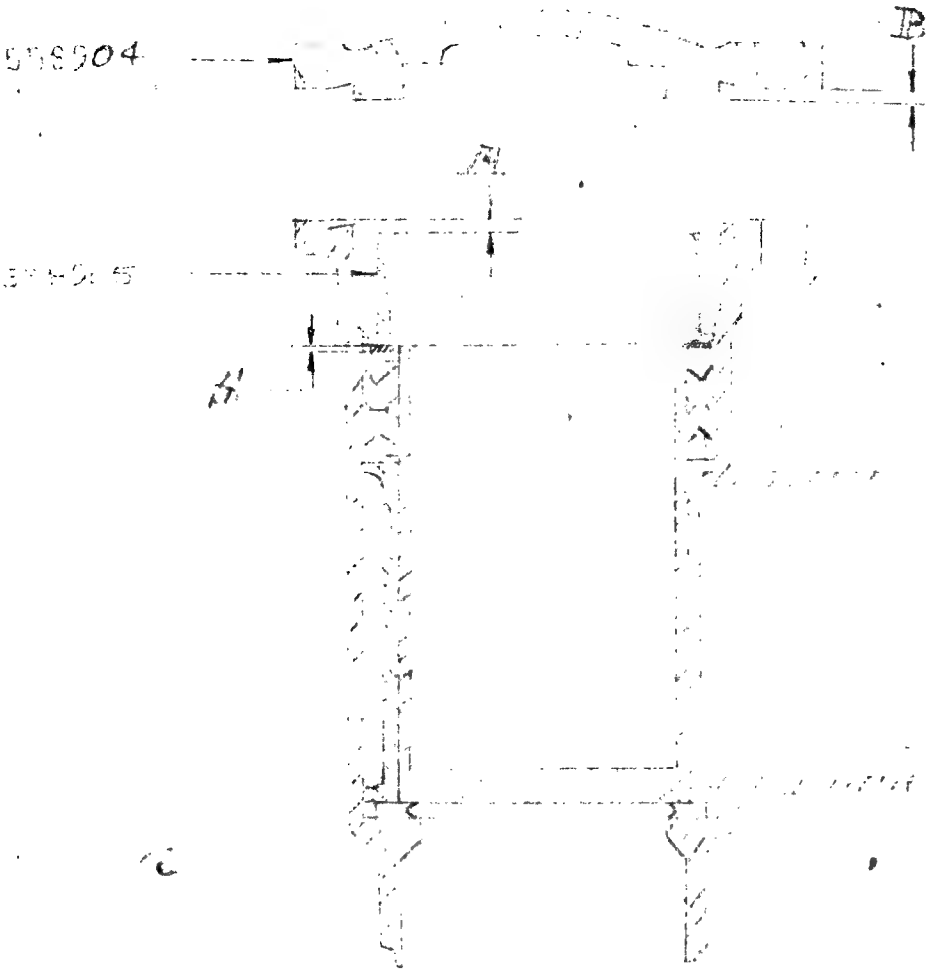


SHIMMING

SHIM USED	REQ'D SHIM THICKNESS	SHIM ACT.	ASS'Y	INSP.
515298	X=[A-(B+C)]+.015			

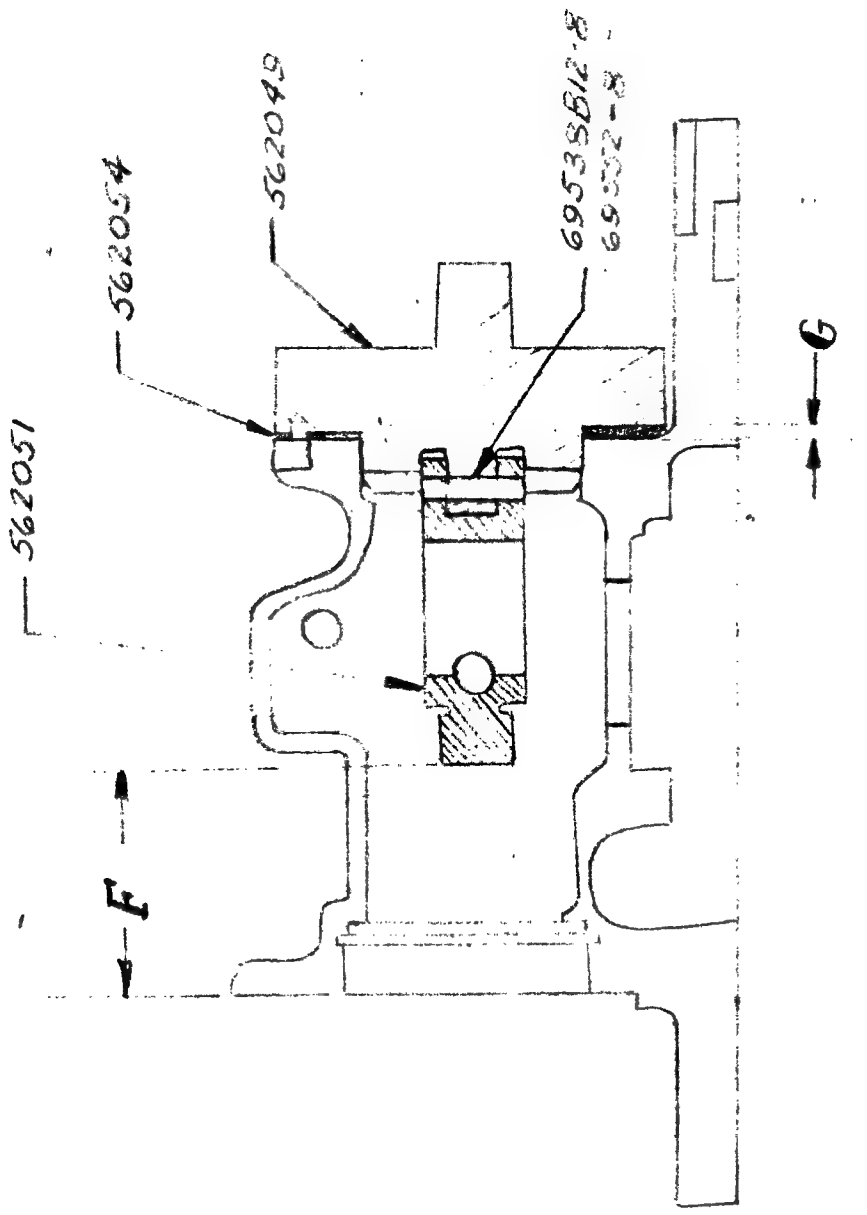
JFC 51

SHIMMING PROCEDURE FOR ZONE I MIN-PRESSURE SHUT OFF VALVE AND RECIRCULATION FLOW VALVE



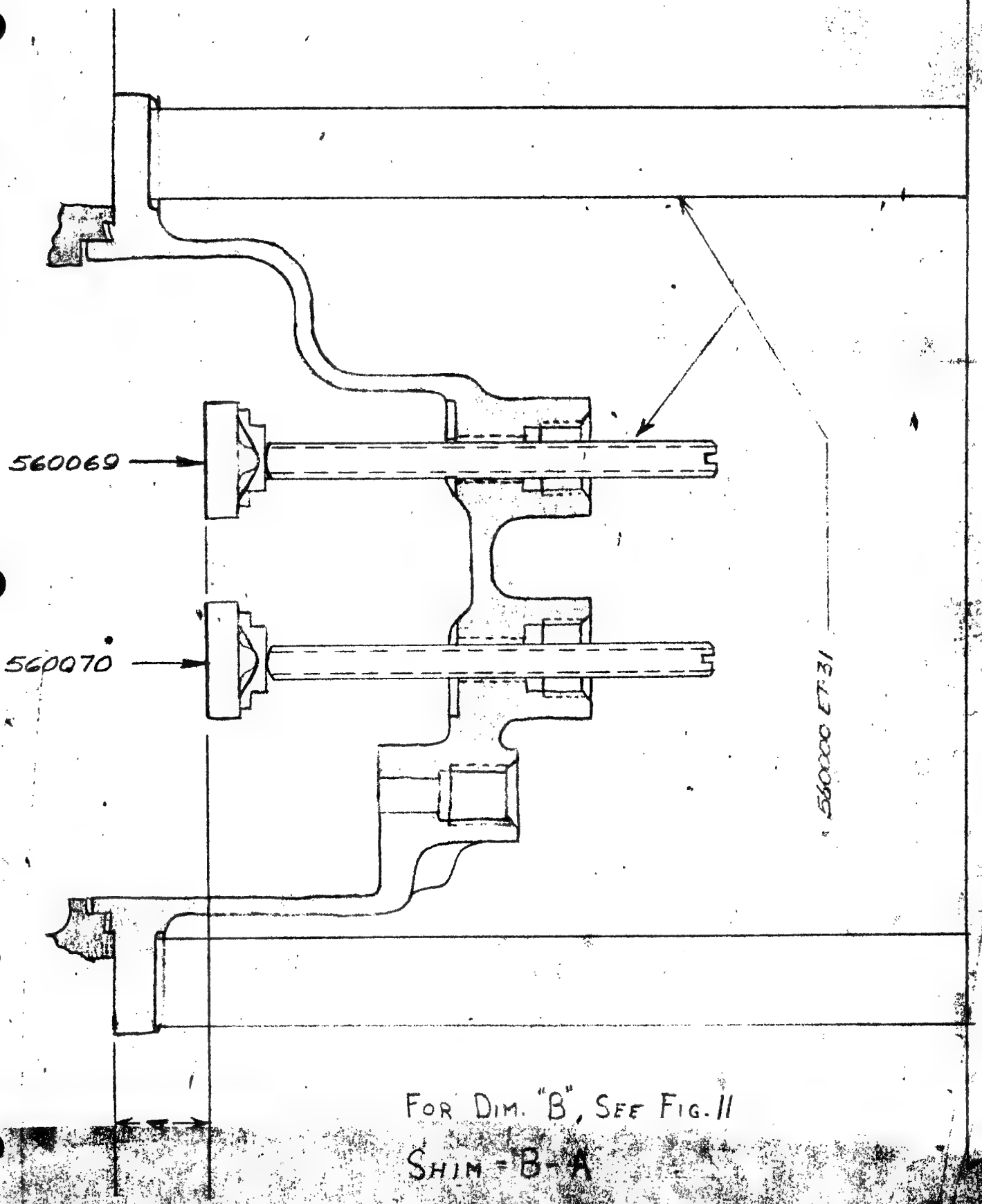
SHIM THICKNESS S = A - B - .002 T.O.L.

SHIM P/N: 569669



No shim if $(5620554) = (X-E)+[(D+E)-A] \pm .001$

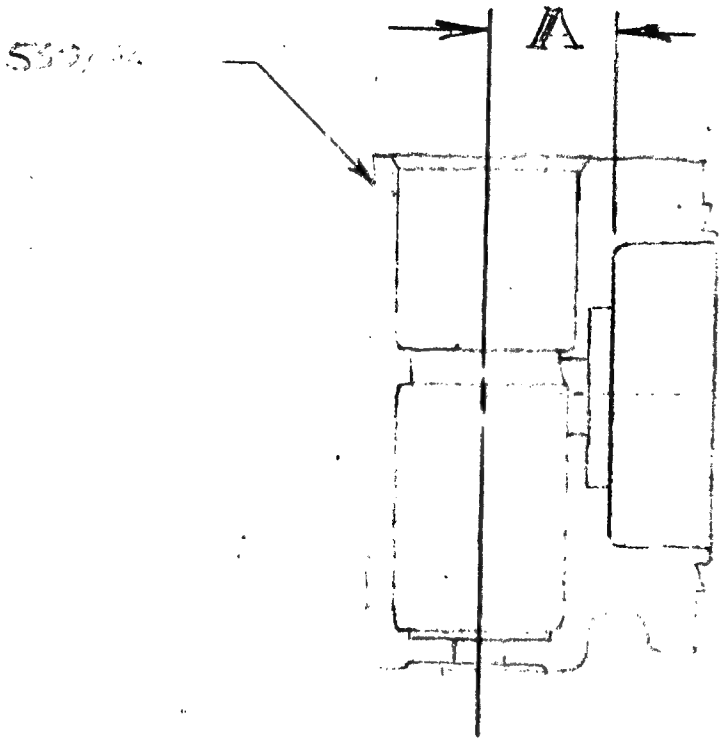
"C" Dim = "F" ± .300

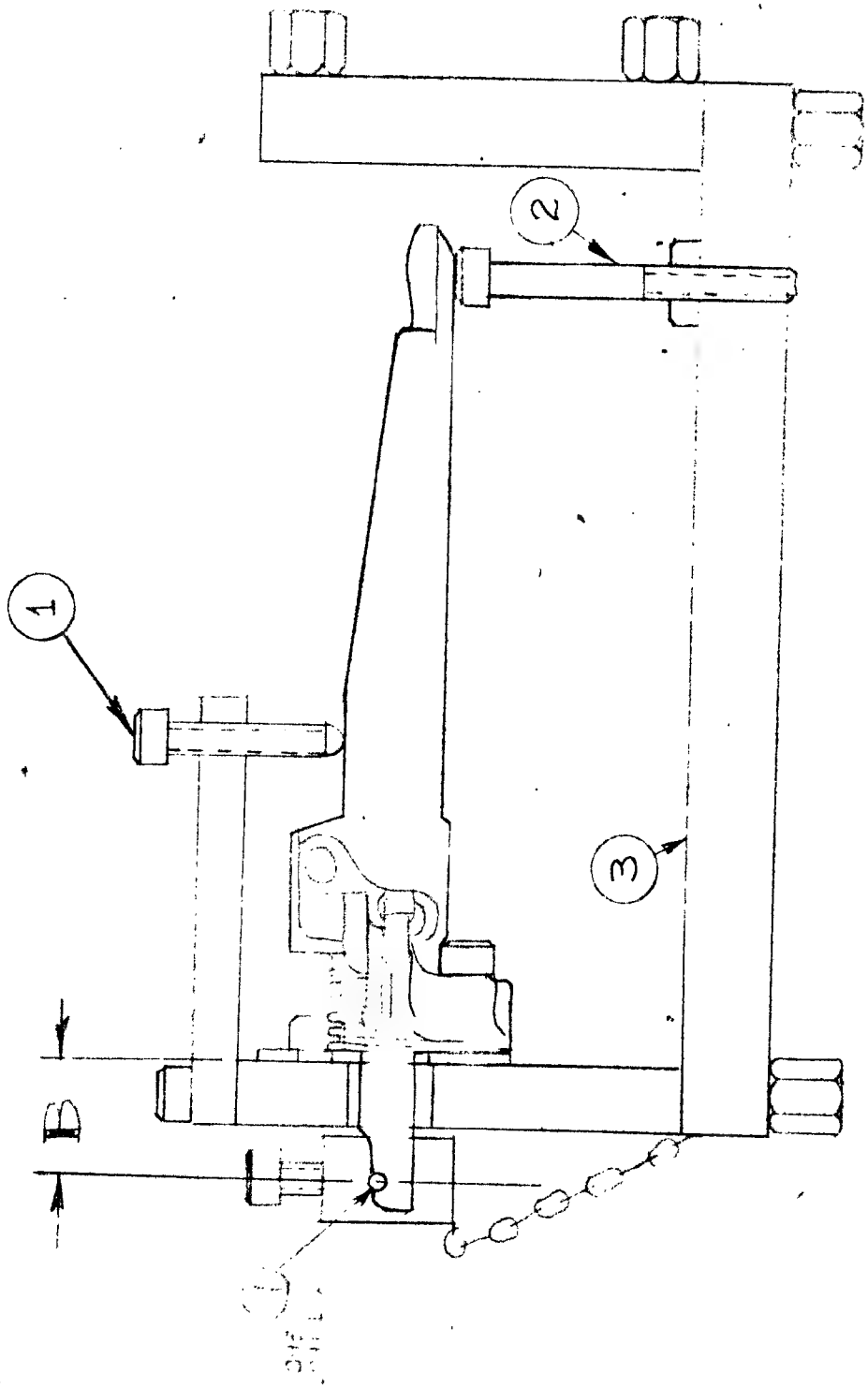


FOR DIM. "B", SEE FIG. 11

SHIM = B - A

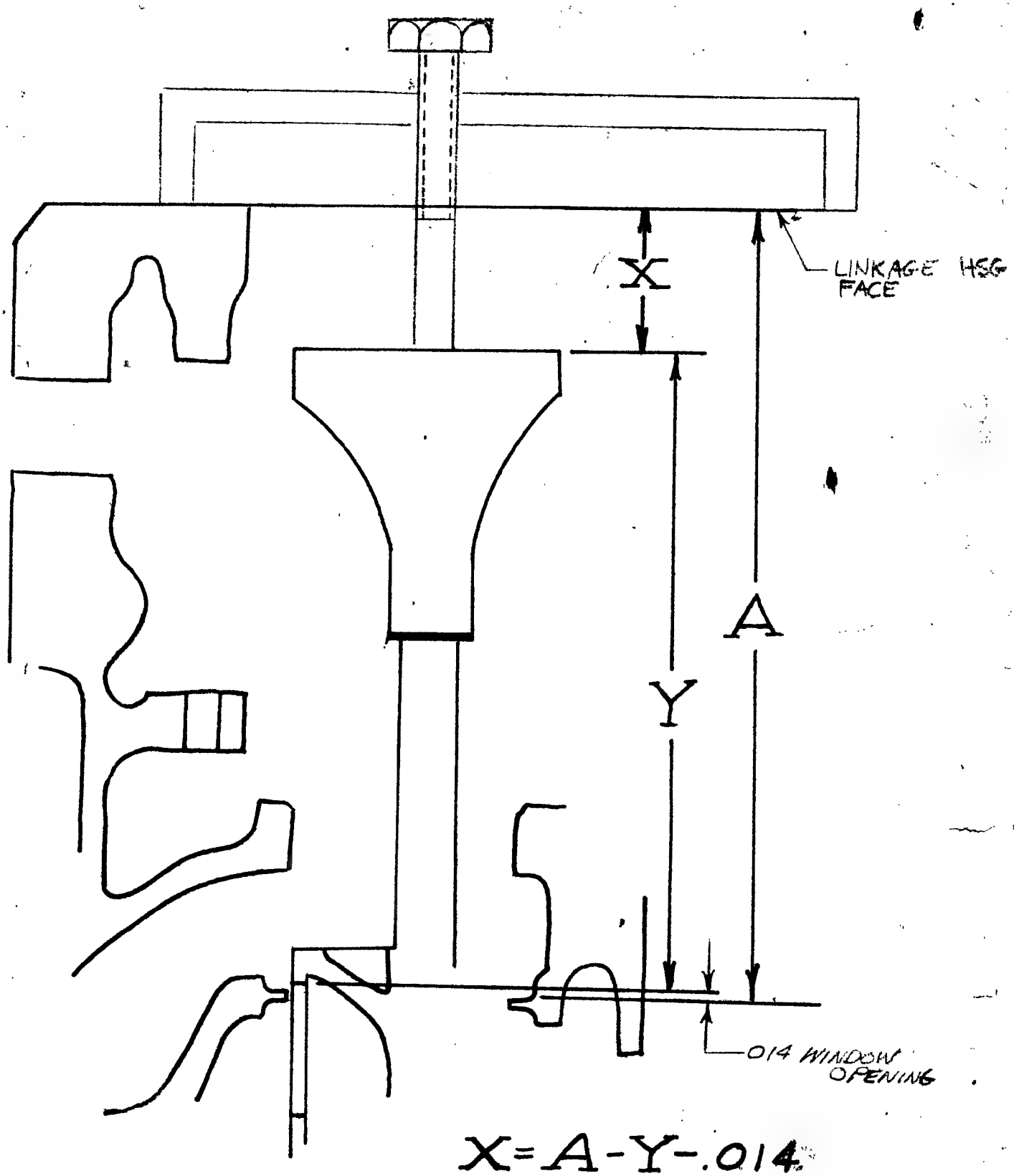
FIG. 20





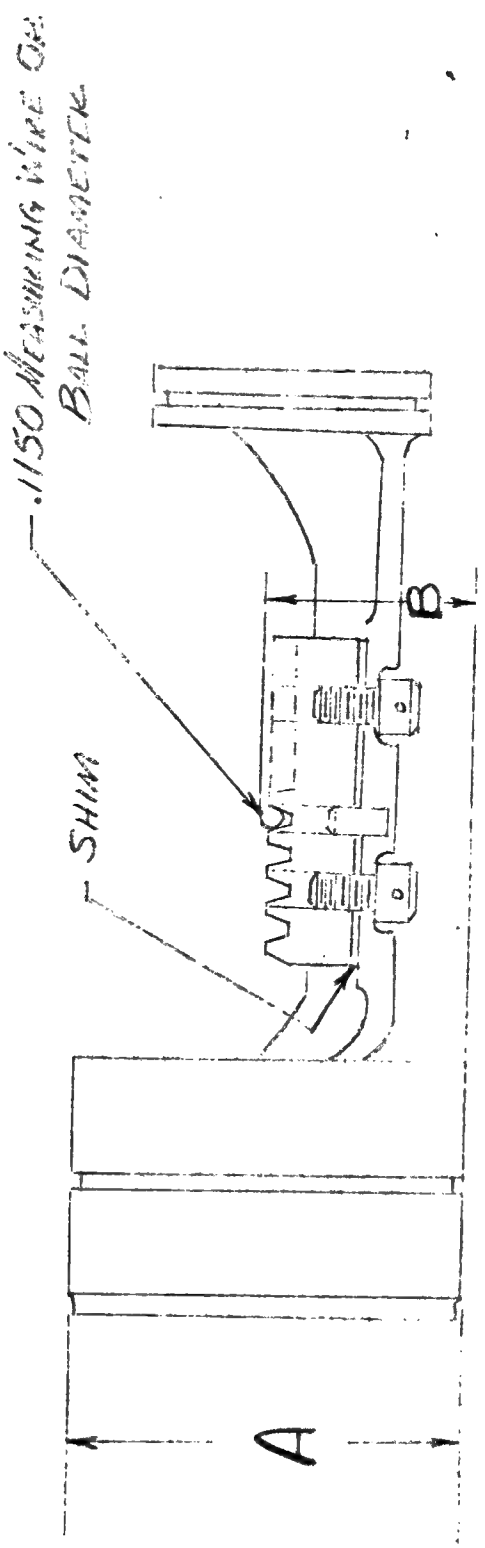
L-7208 23 TRANSFER ROLLER SHIMMING PROCEDURE

FIGURE 22



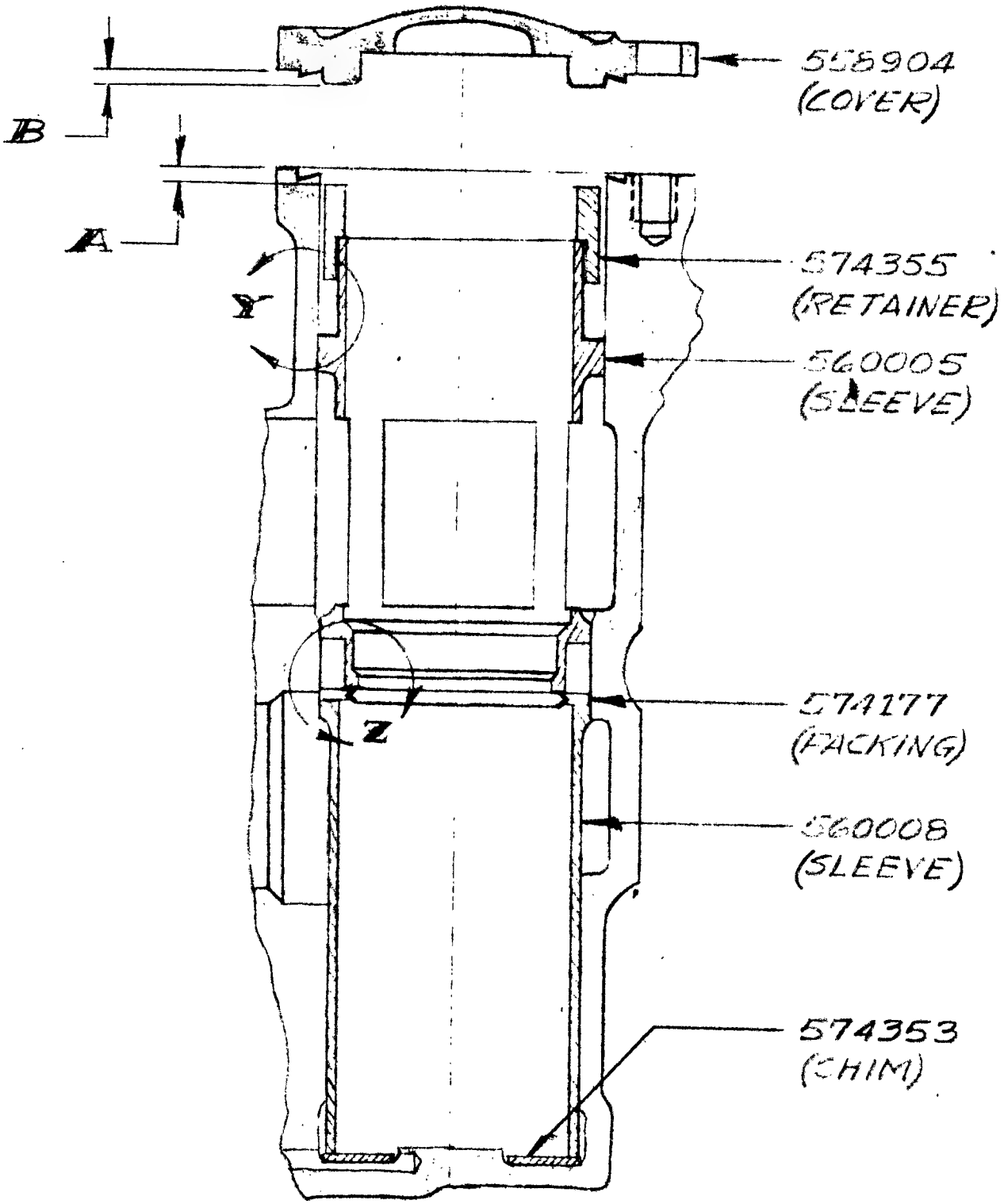
$X = A - Y - .014$

L-7208-1112 Two Piece Pump Control Power Piston



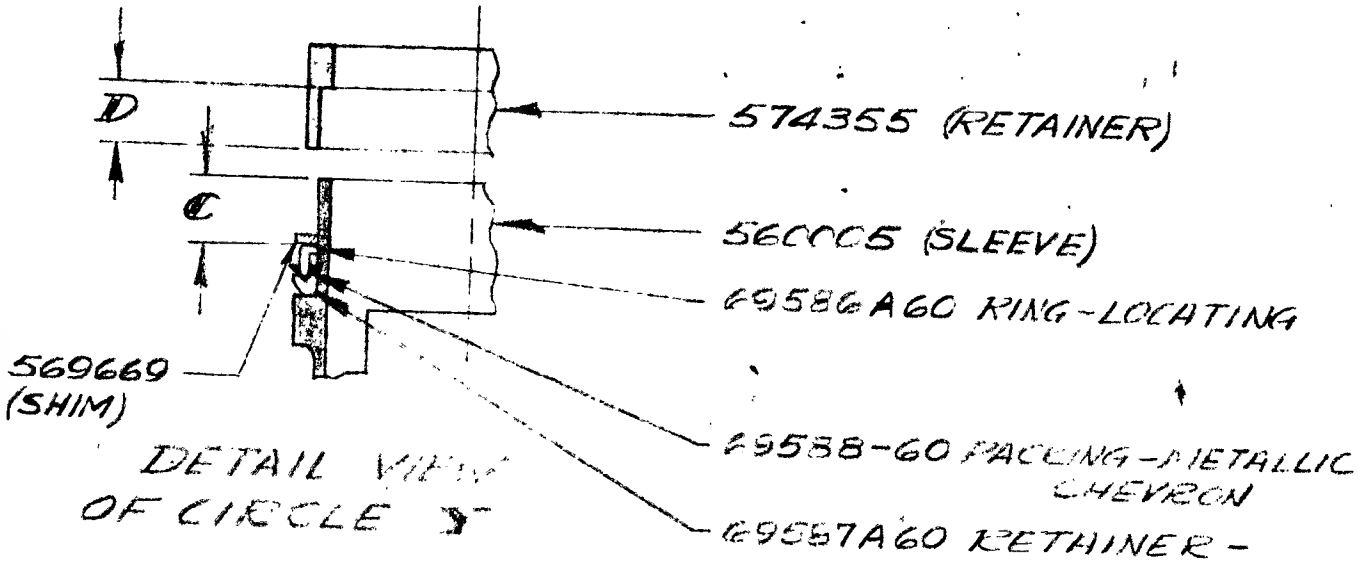
$SHIM = B - \left(\frac{A}{2} + .068\right) \pm .001$

PEAK REG. VALVE & S.O.V. SHIMMING



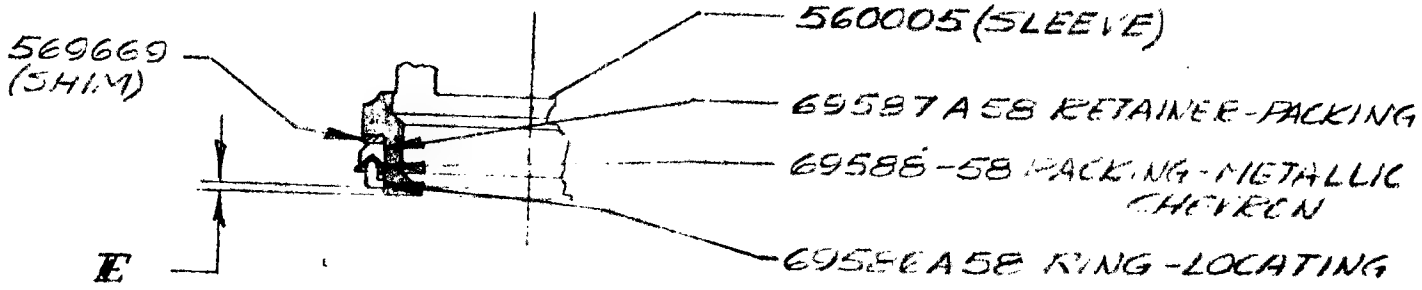
SHIM THICKNESS = A − B − (.002 TO .004)

SHIMMING - PEAK REG. VALVE & S.O.V. SLEEVE CHEVRON'S



DETAIL VIEW OF CIRCLE Y

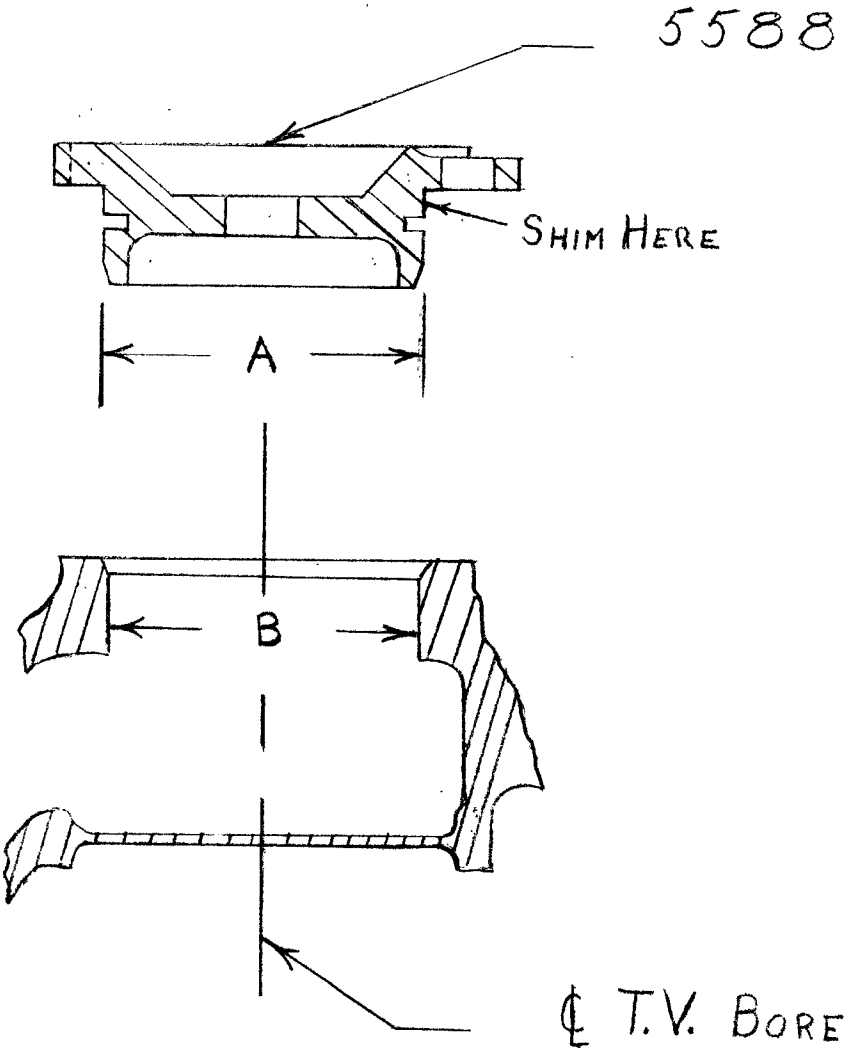
SHIM THICKNESS = C - D - (.002 TO .004)



SHIM THICKNESS = E - (.002 TO .004)

DETAIL VIEW OF CIRCLE Z

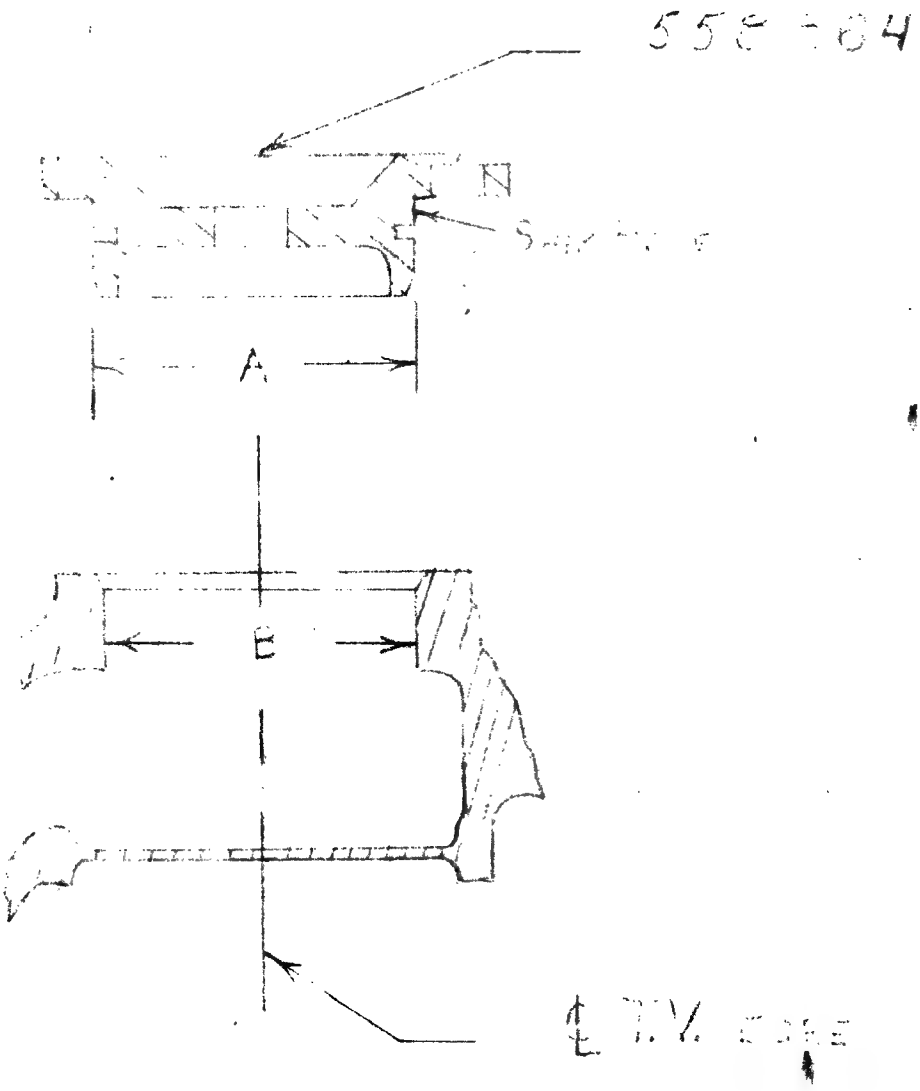
T.V. COVER



SHIM THICKNESS = B-A

USE SHIM SK45400

T.V. COVER



HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT

H.S. 1373B
Amend. 1
Page 1 of 12
E. C. FF67626
Date 11-27-61

H.S. 1373B "Afterburner Control JFC-51 Acceptance of"

Amendment 1

1. In paragraph 1.2.6.6 change that part which reads "0-80 psi" to read "0-150 psi."

2. In paragraph 1.3.2.4 change "PcB" to read "Pcb."

3. In paragraph 3.1 change from "all two outlets ....." to read "both outlets ..."

3A. In paragraph 4.1 change from "3.853 ± .002 ..." to read "3.880 ± .001 ..."

4. In paragraph 3.2 change from "gages across the total flow throttle valve and the peak ....." to read "gage across the total flow throttle valve, 150 across the peak ....."

5. In paragraph #5.1 change from "Set PLA; Max. increase ...." to read "Set PLA = Max., increase ....."

6. In paragraph 7.1 change from "Set PLA = max. P_B = 15." to read "Set PLA = max., P_B = 15."
Change from "Repeat at P_B = 50 & 100 differential....." to read "Repeat at P_B = 50 & 100, differential ....."

7. In paragraph 8.1 change from "increase P_B = 15 ± K, bleeds closed." to read "increase P_B to 15 ± K, bleeds closed."

8. In paragraph .9.2.1 change from "para.1.2.4 ...." to read "para. 1.2.3.1...."

9. In paragraph 10.5 change third sentence from "Adding shims ....." to read "Removing shims ....."

10. In paragraph #16.1 change from "See appendix B-1. For Limits hysteresis ..." to read "See appendix B-1 for limits. Hysteresis ....."

11. In paragrph #17.1 change from "See appendix B-2. For limits hysteresis ..." to read "See appendix B-2 for limits. Hysteresis ...."

12. Appendix E-1 Delete table entitled:

"Wf Zone 2 ΔP Injection Manifold Psi"

HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT

H.S. 1373B
Amend. 1
Page 2 of 2
E. C. FF67626
Date 11-27-61

H.S. 1373B "Afterburner Control JFC-51 Acceptance of"

Amendment 1

13. Appendix F, para. 3.2 change the last two sentences from:

"subtract this amount of shims from the multiplying lever pivot bracket. Add if C.W." to read "add this amount of shims to the multiplying lever pivot bracket. Subtract if C.W."

14. Appendix F, para. 8.3 change from "B = .010 + gap ...." to read "B-.010 + gap ..."

15. Appendix F, para 10.1 change from "dimensions (A), (B), (C), and (D) ..." to read: "dimensions (A), (B), (C), (D), and (E)....."

16. Appendix F, para. 12.2 change from "balance bar (5600112)...." to read "balance bar (560112)....."

17. Appendix F, para. 12.6.1 change from "Shim thickness = B-A." to read "Shim thickness = A-B."

18. Appendix F, para. 13.4 change from "Shim thickness = S-A-B-(.002 to .004)". to read "Shim thickness S=A-B-(.002 to .004)."

19. Appendix F, para. 15.4 change from "Dim. C-F-300." to read "Dim C=F-.300."

20. Figure 3 change from "Dim. A=3.853 ± .002" to read "Dim. A = 3.880 ± .001"
Figure 3 change from "Shim thickness = A ± 3.853" to read "Shim thickness = A ± 3.880"

21. Figure 10 change note callout from "apply 40#" to read "apply 70#."
change note from "shim under nozzles to obtain .080 - .010 gap" to read "shim under nozzles to obtain .008 - .010 gap."

22. Figure 19 Change from "Shim = B-A" to read "Shim = A-B"

23. Figure 20 Change equation from "Shim = $B-(\frac{A}{2}+.068) \pm .001$" to read "Shim = $(\frac{A}{2}+.068)-B \pm .001$."

24. Figure 26 Change equation from "Shim Thickness = B-A" to read "Shim Thickness = $\frac{B-A}{2}$"

HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT

H.S. 1373B
Amend. 2
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E. C. AZ68890
Date: 5-12-62

H.S. 1373B "AFTERBURNER CONTROL JFC51 ACCEPTANCE OF"

Amendment 2

1. Change paragraph 1.2.1 to read:

   1.2.1 "Test fluid will be PMC9073 for all testing except paragraph 24.0 where P & WA 523B must be used. Maintain control inlet and flow meter inlet at 95°F ± 5°F."

2. Change paragraph *24.1 to read:

   *24.1 "The following items shall be run at room temperature ambient conditions and fuel temperatures of 150° - 175°F with P & WA 523B Fuel."

3. Change paragraph *24.3 to read:

   *24.3 "The following items shall be run under room temperature ambient conditions and fuel temperatures of 350° - 375°F with P & WA 523B Fuel."

1.0 GENERAL INFORMATION

1.1 SCOPE

This specification covers the method for testing the model JFC51 Afterburner Fuel Control 576400.

1.2 Equipment Required

Flow bench with a boost pump capable of supplying 10-70 psig fuel pressure to the main pumps in a closed loop system of operation. Main pumps capable of supplying 65000 PPH at 1000 psig pump discharge pressure. Two metered flow meters; Zone 1 and Zone 2. Zone 1 meter must be accurate to 0.5% in the 3000 PPH to 50000 PPH range and the Zone 2 meter must be accurate to 0.5% in the 1500-25000 PPH range. A recirculation line flowmeter accurate to 1.0% in the 350-5000 PPH range. An internal leakage flowmeter accurate to 2.0% in the 350-3000 PPH range. Pump discharge pressure to be controlled as a function of pump controller output thru a system of relief valves in pump discharge line.

1.2.1 Test fluid will be PMC9073 for all testing except paragraph 1.2.8 where P & WA 523B must be used. Maintain control inlet and flow meter inlet at 100° ± 5°F.

1.2.2 Pneumatic pressure source and two gages for simulating engine burner pressure capable of maintaining for a minimum period of 0.5 hour any pressure between 10 and 300 PSIA. One gage 0 to 300 psia accurate to ±0.25 psia over a range of 50 to 300 psia.

1.2.3 Constant temperature baths capable of maintaining temperature of -65°, 0°, +60°, & +150° within ±5°F.

1.2.3.1 Temperature equipment to maintain temperatures from +150°F. to +950°F. during Hot testing. Temperatures to be accurate within ±10°F.

1.2.4 Thermocouple and indicating unit with ±3°F. accuracy for measuring temperatures between -65°F. to 300°F. and with ±5°F. accuracy between +300°F. and 950°F.

1.2.5 Temperature cam calibration follower and dial indicator 560000 ET-7.

1.2.6 Gages for taking the following measurements within the specified accuracy.

1. Control proof pressure: 0-1500 psi with 1.0% accuracy of full scale reading.
2. Control inlet pressure (Pin): 0-1000 psi with 1.0% accuracy of full scale reading.

1.2.6 Continued:

3. Control outlet pressure (Pout): Two gages Zone 1 and Zone 2: 0-1000 psi with 1.0% accuracy of sull scale reading.

4. Control body pressure (Pcb); 0-150 psi with 1.0% accuracy of full scale reading

5. Total flow throttle valve differential gage (ΔPTFTV): 0-80 psi with .75% accuracy of full scale reading.

6. Peak flow throttle valve differentail gage (ΔPPFTV): 0-150 psi with .75% accuracy of full scale reading.

7. Pump Controller differential gage: 0-200 psi with .75% accuracy of full scale reading.

8. Rig boost pressure (Prb): 0-100 psi with 1.0% of full scale reading.

9. Spare Gages:

   1. 0-600 psi with 0.5% accuracy of full scale reading.
   2. 0-800 psi with 1.0% accuracy of full scale reading.
   3. 0-1000 psi with 1.0% accuracy of full scale reading (2 gages)

1.2.7 Separate pressure source capable of supplying 200 PPH at fuel pressures of 50-750 psig.

1.2.8 Provisions for testing the control at +350°F. Fuel Temperature with P & WA 523B Fuel.

1.2.9 Back pressure schedule as indicated in Appendix E-1.

1.2.10 Equipment to apply a 25-30in-# CCW Torque to the pump control shaft.

1.2.11 Sanborn Recorder.

1.2.12 X-Y coordinate plotter.

1.2.13 Angular position indicator to supply pump control output shaft position input to Sanborn recorder.

1.2.14 Preliminary Checks

1.2.14.1 The fuel control shall be assembled using the shimming procedure in Appendix F of this specification. The procedure is to act as a guide only, and may be varied as necessary to satisfy control calibration flow schedule requirements.

1.2.14.2 All valves must be stroked in their mating bores through at least 100 cycles according to the stroke requirements listed in Appendix G. During cycling, Dominion A Spindle Oil obtainable from Atlantic Refining Co., 1351 Main St., East Hartford, Conn.

1.2.14.2 Continued:

Note: One cycle consists of moving the valve from its original position through the required stroke, and then returning the valve to the original position.

Caution: During cycling, valve should not strike bottom of bore nor be withdrawn from its mating bore in a manner that would damage valve sharp edges.

1.3 Test Requirements

1.3.1 The following readings shall be recorded at each calibration point.

1. Total Metered Fuel Flow - - - - - - - - - - - Wft
2. Absolute Burner Pressure - - - - - - - - - - PB
3. Inlet Bulb Temperature - - - - - - - - - - - TT2
4. Power Lever Angle - - - - - - - - - - - - - PLA
5. Compressor Bleed Position - - - - - - - - - CBA
6. Throttle Valve Differential - - - - - - - - T.V. Δ P
7. Pump Controller Differential - - - - - - - P.C. Δ P

1.3.2 The following readings shall be recorded at the beginning and end of the variable input during calibration.

1. Control Inlet Pressure - - - - - - - PSIG - - - - -Pin
2. Control Outlet Pressure - - - - - - - PSIG - - - - -Pout
3. Test Fluid Temperature - - - - - - - - °F
4. Control Body Pressure - - - - - - - -PSIG - - - - - P_{cb}

1.3.3 The following readings shall be recorded when noted:

1. Zone 1 Fuel Flow - Wf1
2. Zone 2 Fuel Flow - Wf2
3. Peak Fuel Flow - Wfp
4. Arming Signal - PS/C
5. Transfer Point - Wf and PB
6. Pressure in recirculation line PR.

1.3.4 The following abbreviations, in addition to the foregoing are used in this specification:

1. Clockwise ----------CW
2. Counterclockwise ----------CCW
3. Military PLA ----------MIL* (wide open throttle)

1.3.5 Accuracy of settings:

1. PB settings shall be held exact.
2. Tt2 settings shall be held to ±5°F.
3. Wf shall be read exact.

2.0 INSPECTION REQUIREMENTS

2.1 The items marked with as asterisk (*) in this specification are inspection items and as such must be under inspection surveillance.

2.2 Retest Requirements: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings Listed under corresponding "Retest" must be retested and settings not yet tested must be completed.

Reset	Retest
PB Servo (8.0)	14.1.1, 14.2.1, 14.4.1, 14.4.2, 14.4.3
Temperature Servo (9.0)	14.1.1, 14.4.1, 14.4.2, 14.4.3
Total Flow T.V. (10.0)	14.1.1, 14.2.1, 14.4.1, 14.4.2, 14.4.3
Zone 2 Transfer (12.0)	14.5.1, 14.5.2
Power Lever (6.1)	6.2, 6.3

Replace	Retest
Servo Housing	8.0, 14.1.1, 14.2.1, 14.4.1, 14.4.2, 14.4.3
Temperature Servo	9.0, 14.1.1, 14.4.1, 14.4.2, 14.4.3
Transfer Housing	12.0, 14.5.1, 14.5.2
Zone 1 Outlet Housing	14.8.2.1, 14.8.2.2
Zone 2 Outlet Housing	14.6.1, 14.8.1.3, 14.8.2.1, 14.8.2.2
Pump Controller	7.1, 7.2.1, 7.2.2

2.3 No adjustments or changes in parts shall be permitted during the final, inspected, test of the control.

3.0 INSTALLATION INSTRUCTIONS

3.1 Install control on drain table in a position similar to normal engine mounted position (Ref. P & WA Layout 203578), connect Pump Discharge to Control Inlet, both outlets must be connected to separate flowmeters.. Recirculation and Internal Leakage lines must also be connected to separate flowmeters.

3.2 Install 80 psi differential gage across the total flow throttle valve, 150 psi across peak throttle valve, also install 200 psi differential gage across the total flow T.V. and inline regulator.

3.3 Install a separate fuel pressure source to the speed signal valve.

3.4 Make sure that there are no open fittings on control and the internal leakage line is not "dead headed."

3.5 The flowmeter density adjustments shall be set in accordance with actual density measurements during Hot Fuel Tests.

4.0 EXTERNAL LEAKAGE

4.1 With PLA at Max A/B, set boost pump pressure to 60 ± 15 psig. There shall be no external leakage except:

a) No more than 30DPM from the PB drain.
b) No more than 30DPM from the Pump Controller Drain.

The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

5.0 PROOF PRESSURE TEST

5.1 With PLA at max., increase Wf to 10,000 ± 500 PPH. Close outlet valve until pin is 2500 ± 20 psi. Maintain this pressure for a time period not to exceed 1 minute. There shall be no external leakage. Open outlet valve. The term "no leakage" shall be applied as defined in paragraph 4.1.

6.0 POWER LEVER SEQUENCE

6.1 Increase power lever angle until a position is reached where the PL Servo Piston moves .001-.005. Lock PL in place and adjust protractor slip ring until it reads 67°. At this position adjust the stop plate until the hole in the stop plate lines up with the slot in the index ring. Be sure protractor slip ring and stop plate are locked in position.
CAUTION: Be sure PL servo piston is not hitting the min line stop (cover or screw in cover) when finding the .001 - .005 motion position.

6.2 Set PLA-Max., PB-15. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust T.O.P.V. cam until the recirculation valve closes and the Zone I S.O.V. is open.
CAUTION: Torque on adjusting screws to be 15-20 in-lbs.

6.3 With the same settings as 6.2, determine actuation by noting that when increasing the power lever, the signal pressure to the recirculation valve is Pin to Pin -20 psi, and the signal pressure to the Zone I S.O.V. is PBody +20 psi.

7.0 PUMP CONTROLLER CALIBRATION

7.1 Set PLA - max., PB = 18. Adjust spring pre-load on pilot valve until pressure differential between sensor inlet pressure is 75-80 psi. Repeat at PB = 50 & 100 differential pressure must remain at 70 - 90 psi.

7.2 DYNAMIC PERFORMANCE

*7.2.1 Integration Rate

Disconnect pump controller shaft from Rig Output Flow Control. Set PLA at 120°, T12 at 60°F, Pb at 100 psia, bleeds closed; adjust Rig Output Flow Control to create a Δ P (1-3) of 85 psi. Obtain a transient recording of Δ P (1-3) and pump controller output shaft angular position while making a step change to decrease ΔP (1-3) 3 to 9 psi below the pump controller setting. The angular rate of the pump controller output shaft shall be within 1/4 to 1/2 degrees per psi error per second.

*7.2.2 Slew Rate Position

Disconnect Pump Controller Shaft from stand output flow control. Set PLA at 120°, T12 at 60°F., Pb at 100 PSIA, bleeds closed, adjust stand output flow to decrease Δ P (1-3) the amount necessary to cause the Pump Controller Arm to move at its "Slew Rate". Δ P (1-3) to get this slew rate shall be 8 to 12 psi below the Pump Controller setting. Shim under proportional piston spring to meet this requirement (Ref. Fig. 31)

*7.2.3 Slew Rate

Disconnect pump controller shaft from stand motor control. Set PLA at 120°, T12 at 60°F, Pb at 100 psia, bleeds closed; adjust motor control to create ΔP (1-3) of 85 psi. Obtain a transient recording of ΔP (1-3) and pump controller output shaft angular position while making a step change to decrease ΔP (1-3) 15 to 20 psi below the pump controller setting. The angular rate of the pump controller output shaft shall be at least 90° per second.

7.3 Set PLA = max. Increase PB until Wf = 25000 PPH. Adjust sensor for inline regulator until differential across total flow T.V. is 40 psi.

8.0 PB SERVO CALIBRATION

NOTE: Refer to Build-up Sheet for Dim. K L-7208-12. If Dim. K is Plus (+) add this amount to the below PB pressures.

8.1 Set PLA = 68°, increase PB to 30 ± K, bleeds closed. Adjust PB position adjustment until cam follower is in bottom of the detent on the PB cam.

NOTE: Bottom of detent is determined by change of motion on dial indicator. Bottom of detent is located at point where indicator reverses direction no more than (+.0001).

8.2 Increase PB to 215 ± K. Shim C.B.A. pushrod until cam follower is in bottom of high PB detent.

8.3 Repeat 8.1 and 8.2 until detents are set.

8.4 Set PLA = 68°, bleeds open. Vary PB from 5 to 215. Locate low and high PB detents. Difference between detents msut be 155 ± 2 psi. Adjust CPA pushrod ball follower until this difference is obtained.

8.5 Set the bleeds in the closed position and determine that the Tt2 cam detents are still located at 30 ± K and 215 ± K psia.

8.6 Repeat items 8.1 thru 8.6 is required.

9.0 TEMPERATURE SERVO CALIBRATION

9.1 Set PB = 30 ± K, PLA = max, Tt2 = -65°F., bleeds closed. Adjust position spring on the Tt2 input lever until the cam calibration follower just starts to come out of the detent (± .0001).

9.2 Set PB = 30 ± K, PLA = max. Tt2 = +950°F., bleeds closed. Adjust rate spring on the flapper until the cam calibration follower just starts to come out of the detent (± .0001).

9.3 Repeat items 9.1 and 9.2 until the detents are set.

10.0 TOTAL FLOW THROTTLE VALVE CALIBRATION

10.1 Set PB = 50, PLA = 68°, Tt2 = 60°F., bleeds closed. Record total flow T.V. displacement and total metered flow. Increase PB until disp. changes .100. (T.V. rate is 95.4 PPH/.001). Wf must change by 9540 PPH ± 100 PPH. Adjust inline sensor Δ P until set.

10.2 Bleeds closed, PLA=0, Tt2=+60°F., PB=200. Recirculation flow must be 3000 PPH. Adjust minimum flow stop until this Wf is obtained.

10.3 Set bleeds closed, Tt2 = 65°F. Set PLA = max and read Wf at 50 & 90 PB. Then set PLA = min and read Wf at 75 & 150 PB. Plot these readings. A straight line drawn thru 50 & 90 on the max line and 75 & 150 on the min line must intersect at -2 PSIA and -200PPH. The actual intersection will be defined by finite values of Wf and PB (Wf and Pb error).

10.4 Bleeds closed, Tt2 = -65°F., PB = 15, PLA = max. Adjust T.V. multiplying lever hinge until Wf error is reduced to -200pph.

10.5 If data lines determined in 10.3 do not intersect at -2 psia it will be necessary to reshim the T.V. multiplying lever hinge. Approx. .006 shims will change intercept 1 psi. Adding shims will move intercept to left (minus).

10.5.1 Set PLA = max, PB = 100, Tt2 = -65°F., bleed closed. Record Wf. Increase Tt2 to +300°F. and record Wf. Differential Wf between -65°F. and +300°F. must be 6700 ± 250PPH. Adjust the Tt2 cam bias adjustment until this differential is obatined.

10.6 PLA = 67°, PB = 100, Tt2 = +60°F., bleeds closed . Adjust power lever servo pilot valve position until Wf = 7420 PPH.

10.7 Set PLA = Max., PB = 100, Tt2 = -65°F., bleeds closed. Adjust the power lever rate adjust (linkage bracket) until Wf = 43,000 PPH. At this time check stroke of the power lever servo. Stroke must be .900 ± 100 for full power lever movement.

10.8 Recheck 10.6 and 10.7,as slight trimming adjustment may be necessary.

10.8.1 Range of Remote Trim adjustment (PL Servo Rate): Set PB = 100; Tt2 = +60°F; PLA = Max. Turn adjustment clockwise until it bottoms and record total Wf. Turn adjustment ccw until it bottoms and record total Wf. Limits: Adjustment range must be at least 4% of Wf as calibrated. Range determined with this check must be recorded on the final data sheet. Note: Do not repeat this test during final calibration.

10.9 Set PB = 100, Tt2 = +60°F, bleeds closed. At these conditions increase PLA until Wf is 13300 PPH. Adjust power lever stop to contact piston at this flow.

10.10 Set PB = 30 psia; PLA = 120°, Tt2 = +750°F; bleeds open. Wf must be 12390 - 13690 pph. Trim to obtain this Wf by a P.L. servo position adjustment.

11.0 POWER LEVER TORQUE

11.1 Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

12.0 ZONE 2 MANIFOLD TRANSFER

12.1 Pressure in "Y" line must build up to within 10% of its final value within .25 seconds measured from the time it starts to increase. Select bleed size to meet this requirement.

12.2 Set PLA = 65°, PB = 50, Tt2 = +60°F, bleeds closed. Increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 13200-14600 pph. Adjust the C.D.P. transfer power spring to set the correct actuation point.

12.3 Set PLA = 65°, PB = 18, Tt2 = +60°F, bleeds closed. Increase PB = 100, increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 26400-29200.

12.4 Check retransfer (Zone II closes on decreasing PL) according to note in Appendix D.

13.0 PEAK THROTTLE VALVE RATE

13.1 Set PLA = 120°, PB = 50, Tt2 = +60°F bleeds closed. Record Wf in Zone 1. Increase PB to 150 and record Wf in Zone 1. Difference in Wf between 50 and 150 PB must be 22500-23500 PPH. Adjust peak valve sensor until this difference is obtained.

14.0 FINAL CALIBRATION

Note: 1. A torque of 25-30 in -# shall be applied to the Pump Control Output Lever through out the final calib.
* 2. A body press. of 50 ± 20 psig shall be maintained throughout final calibration.
* 3. No adjustments or changes of parts shall be permitted during the final calibration.

14.1 MAX RATIO CALIBRATION - BLEED CLOSED

*14.1.1 Set PLA = 120°, Tt2 = +60°F., bleeds closed. Record total metered Wf, T.V. △P, and P.C. △P at the following PB pressures (Note: Approach PB pressures in increasing direction. PB = 18, 30, 40, 50, 75, 85, 120, 145, 180, 200, 145, 85,50 and 18 psia. See appendix A-1 for limits. Hystersis must be within the limits defined in appendix A-1. Record return to Pump Inlet Flow at 18 & 200 psia.

14.2 MIN RATIO CALIBRATION - BLEEDS CLOSED

*14.2.1 Set PLA = 68°, Tt2 = 60°F., bleeds closed. Record total metered Wf, T.V. △P, and P.C. △P at the following PB pressures; 18, 40, 100, 200, 100 and 40 psia. See appendix A-2 for limits. Hysteresis must be within the limits defined in appendix A-2. (Note: Do not overshoot when setting PB pressures.)

14.3 POWER LEVER SEQUENCE AND TRANSIENT

*14.3.1 Set PLA = 120°, Tt2 = +60°F., PB = 18, bleeds closed. Decrease PLA to 0°, then slowly increase PLA. At 66° - 67° the recirculation valve must close at or after the time at which the Zone I primary manifold S.O.V. opens . Increase PLA to 120°. Slowly decrease PLA and record PLA at which S.O.V. closes. PLA must be within 65° -67° when S.O.V. closes. Recirculation valve must open at or before the time at which the S.O.V. closes.

*14.3.3 Set Pb = 100 psia and Tt2 = +60°F. Change PLA from 67° to 120° within .8 to 1.2 seconds. The control fuel flow shall increase at a rate not to exceed 300 Wf/Pb ratios per second and complete 90% of the transient in 2 seconds or less.

*14.3.3 Set Pb = to 100 psia and Tt2 = to +60°F. Change PLA from 120° to 67° within .8 to 1.2 seconds. The control fuel flow shall complete 90% of the transient in 2 seconds or less.

*14.3.4 Set Pb = 100 psia and Tt2 = +60°F. Bleeds closed. Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

14.4 TEMPERATURE (Tt2) SENSING CALIBRATION - (See Appendix C-1 for limits)
NOTE: All temperatures (Tt2) to be actual bulb temp. for final calibration.

* 14.4.1 Set PLA = max, Tt2 = -65°F., bleeds closed. Record total metered Wf at the PB pressures noted in Appendix C-1. (Note: Approach PB pressures in increasing direction.)

*14.4.2 Repeat item 14.4.1 at temperatures (Tt2) of +150°F, +300°F.

*14.4.3 Repeat item 14.4.1 with bleeds open at Tt2 of +300°F, +550°F.& +750°F.

*14.4.4 The force required to open and close CBA pushrod shall not exceed 25 lbs., when body pressure is at 50 psig.

14.5 MANIFOLD TRANSFER AND PEAK SYSTEM CALIBRATION

*14.5.1 In the following calibration record Zone I Fuel Flow (Wf1) at the manifold transfer points. A coordinate system plotter (X,Y) is required for this calibration. A plot of Wf1 vs PB shall be made for all calibration points. An indication must appear on the chart when the Zone II regulator opening pressure increases a minimum of 50 psi above control body pressure. This pressure increase indication must occur within the transfer limits defined in Appendix D-1. At each of the specified PB settings decrease PLA. from max at a rate no faster than 2°/sec until retransfer occurs. Retransfer shall occur within the limits specified in Appendix D-1.

*14.5.2	Set PLA = 68°, PB = 18, Tt2 = +60°F., bleeds closed. Increase PLA no faster than 2°/sec.record transfer and peak flow points at PB of 18, 30, 50, 100, 150 and 180. See Appendix D-1 for limits.
*14.5.3	Repeat 14.5.2 with bleeds open. See Appendix D-1 for limits.
14.6.0	RECIRCULATION CALIBRATION
*14.6.1	Set PLA = 0°, PB = 100 psia, Tt2 = +60°F., bleeds closed. Metered Wf must be 2850 - 3150 pph. Record control inlet pressure and control body pressure. Control inlet pressure must be within 80-250 psi above control body pressure.
14.7.0	REPEATABILITY CHECKS
14.7.1	Check repeatability in accordance with and in sequence indicated in Appendix H.
14.7.2	Re-run per paragraph 14.7.1 two additional times. Re-run paragraph 14.7.1 a total of 9 additional times only if requested by HS Engineering. Cycle bleeds open to bleeds closed twice before starting each re-run.
14.8.0	LEAK CHECK
*14.8.1	With all instrumentation removed from control, set the PLA at 120°, set PB at 150 psia, Tt2 at +60°F, bleeds closed.
*14.8.1.1	Check external leakage. No leakage allowed except for overboard drain and PB drain. The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.
*14.8.1.2	Check overboard drain leakage. Allowable leakage shall be no more than 10 dpm from the PB drain and 30 dpm from the pump controller drain.
*14.8.1.3	Remove recirculation line fron the control and check recirculation valve leakage. Leakage from the recirculation port must not exceed 20 cc/min.
14.8.1.4	Pressurize overhead drain port on pump controller to 35-40 psig. The external leakage shall not be greater than 8 drops per minute per seal.
*14.8.2	Shut-Off Valve Leakage Note: Allow 3 to 5 minutes for lines to drain before taking leakage reading.
*14.8.2.1	Set PLA = 0°, Tt2= +60°F., PB=15, bleeds closed, with main and boost pumps operating. Remove zone I and zone II outlet lines. Leakage in zone I and zone II must not exceed 10 dpm in either line. Shut down main pump.
*14.8.2.2	Set PLA=0°, Tt2=+60°F., PB=15. Maintain Boost Pressure at 50 psig. Remove Zone I and Zone II outlet lines. Leakage must not exceed 10 dpm in either line.
14.9.0	Power Lever Cam Calibration Check
*14.9.1	Set PB of 100 PSIA; Tt2=+60°F. Set, in sequence, power lever angles of 68°, 75°, 85°, 95°, 105°, 120°, 95°, 75°, 68°. Record total Wf at each point.
*14.10.0	The "K" dimension used in setting up the PB system position must be recorded on the final data log sheets.
15.0	PRESERVATION AND STORAGE
15.1	At conclusion of bench calibration, drain the calibrating fluid from the control and prepare the control for shipment in accordance with H.S. Spec. 380.
15.2	The "dry" weight of the control shall be recorded on the installation inspection sheet.

APPENDIX A-1

PB	Conditions	Total Wf Limits
18	Tt2 = 60°F	6090 - 6730
30	Bleeds	10070 - 11130
40	Closed	12880 - 14260
50		16110 - 17810
75	PLA = 120°	24520 - 27100
85		29350 - 32440
120		43900 - 48530
145		46420 - 51310
180		57100 - 63110
200		60420 - 66780

APPENDIX A-2

PB	Conditions	Total Wf Limits
18	Tt2 = 60°F	2850 - 3150
40		5050 - 5590
100	Bleeds Closed	12635 - 13965
200	PLA = 68°	25270 - 27930

APPENDIX C-1

Temperature Sensing Calibration

Tt2 = -65°F B.C.

PB	Total Wf Limits
18	7110 - 7860
60	23660-26160
100	40830-45130
150	58100-64220
180	60220-66560

Tt2 = +150° B.C.

PB	Total Wf Limits
18	5900 - 6520
60	19610-21680
100	34140-37730
150	49240-54430
180	58510-64670

Tt2 = +300°F B.C.

PB	Total Wf Limits
18	6210 - 6870
60	20710-22890
100	34490-38120
150	51100-56490
180	60120-66450

Tt2 = +550°F B.C.

PB	Total Wf Limits
18	7350 - 8120
60	27490-30390
100	45920-50753
150	60420-66780
180	60420-66780

Tt2 = +750° APPENDIX C-1 (continued)

PB	Total Wf Limits
18	7810 - 8630
30	12390-13690
40	17400-19230
50	21750-24040
80	34740-38400
100	43100-47640
150	60420-66780
180	60420-66780

PB	Tt2 = 300°F B.O.
18	The observed flow readings shall be 19% to 21% higher than the observed flow readings for Tt2 = 300°F B.O.
60	
100	
150	
180	

Note: Hysteresis Wf must be within specified limits

APPENDIX D-1

PB	Transfer Wf B.O.	Peak Wf B.O.	Peak Wf & Transfer Wf. B.O.
18	4750 - 5260	3930-4350	The observed flow readings shall be 19% to 21% higher than the observed flow readings for transfer bleeds closed.
30	7920 - 8760	6550-7250	
50	13200-14600	10900-12100	
100	26400-29200	21800-24200	
150	39600-43800	32700-36300	
180	47400-52600	39300-43600	

Note: On decreasing PL excursion the control must retransfer within the following limits:

A) At PB values of 50 psia or less retransfer must occur at least 200 PPH below but no greater than 500 pph below the increasing Transfer Fuel Flow.

B) At PB values above 50 psia retransfer must occur at least 200 PPH below but no greater than 10 ratio units below the increasing Transfer Fuel Flow.

APPENDIX E-1

Wf	ZONE I Injection Manifold (PSI)
3000	90 - 110
6000	140-165
10000	195-225
20000	300-345
30000	390-440
40000	460-520

NOTE: Zone II manifold press. shall be maintained at a pressure which is 75 psi ± 10 psi below Zone I back pressure at test point.

APPENDIX F

JFC-51 SHIMMING INSTRUCTIONS

Note: These shimming instructions are to be used for initial buildup. Final shim thichness and setting dimensions may be varied to meet the final flow calibration.

1. Power Lever Indexing (REF. L-7208-24; Et-1)

Determine Max. A/B stop, decrease power lever 53° from this point. Insert index pin through the hole in the protractor, index ring, and stop plate. Protractor must read 67° at this point. If necessary, slip the protractor face until it reads 67°. Lock protractor and stop plate in place.

2. Throttle Valve Roller Linkage (REF. L-7208-10)

2.1 Shim Bracket 560169 on peak valve piston such that "bellorank" lever 558961 has a 1:1 lever ratio.

2.2 Obtain dim. A (see Fig 2) prior to installation of peak valve.

2.3 Shim thickness = A - B - 2.00

2.4 Shim Bellcrank Lever to obtain .000 - .003clearance with bracket connection on CDP rod. See Fig. #28,

3. Throttle Valve Multiplying Lever Pivot (REF. L-7208-10)

3.1 Shim the multiplying lever pivot bracket 558958 such that the distance from the centerline of the pivot to the centerline of the rollers 568339 is 1.335 when the peak valve is at 215 psia ± K.

3.2 Set the multiplying lever at an angle of 30° by utilizing fixture 560000ET39 (See Fig.1). Position the peak valve to 215 psia ± K. Zero out dial indicator. Install gage which locates rollers in respect to the centerline of the multiplying lever pivot. Adjust the peak valve position until the rollers are properly located. Determine amount and direction peak valve was moved. If adjusting screw was turned CCW (lower CDP) add this amount of shims from the multiplying lever pivot bracket. Subtract if C.W.

4. Throttle Valve Roller Guide (Ref. L-7208-10)

4.1 Shim position of throttle valve roller guide 558954 such that distance from bottom of roller carriage track to top of metering window in the throttle valve is 3.880 ± .001 (see Fig. 3).

5. Throttle Valve Position Adjustment (Ref. L-7208-10)

5.1 Assemble throttle valve less return springs in control. Position the throttle valve so that it is .010 from bottoming (minimum flow position).

5.2 With throttle valve located as in 5.1 limit the travel of the position adjustment rod 558963 by shimming under spacer 560213 with shims 513029 such that A = B. (See Fig. 9)

6. Power Lever Servo Output Lever (Ref. L-7208-10)

6.1 Install bracket 558966 on Servo Housing.

6.2 Obtain Dim. B, and C as shown on Fig. 4.

6.3 Shim between the Servo Housing and bracket 558966. Shim thickness = 1.080-(B+C).

7. Peak Throttle Valve T_{T_2} Cam (Ref. L-7208-12)

7.1 Determine the height to the centerline of the calibration cam follower A and to the centerline of control cam follower B from the parting line within .0005. (See Fig. 6)

7.2 Calculate Dim. K (to be used in control calibration)

Dim. K = Calib. Cam Follower H_t - Control Cam Follower H_t / .00615 P_b

Note: If Dim. K is minus, Dim. K must be subtracted from b settings specified in the control calibration.

7.3 Measure the following as shown on Fig. 6

C: Height of upper metering window edge in sleeve (569511) from parting line

D: Metering edge of piston (558849) to upper end of piston

(cont'd)

7.3 E. From shim shoulder to spherical radius on guide 558853.

F. From centerline of 30 psia detent on the cam 576075 to the shim shoulder on the cam.

7.4 Shim thickness = B - C + .184 - D - E - F.

7.5 Insert the cam shaft assembly in an arbor press in a vertical position. Apply a 30 lb. load to take the slop out of the pins. Measure the total shim thickness with a feeler gauge as shown in Fig. 6.

7.6 Install actual shim thickness between the 3-D cam and the cam shaft guide (558859).

7.7 Subtract the actual shim thickness from the total shim thickness and install these shims between the 3-D cam and the cam shaft collar (558857).

8. C.D.P. Sensor and Output Lever (Ref. L-7208-11)

8.1 On 561924 Assy determine amount of 560187 shims required to hold dimension "M" .000" - .005" above free position dimension.

8.2 Assemble the 561924 lever assembly and 560188 housing using the shims determined in Paragraph 8.1.

8.3 Install this assembly in fixture ET-560000-ET-43 Figure 5a. Adjust leveling screw until plane "A" defined on 561924 assembly drawing is parallel to plane "X" of fixture within .0005. Install Pin and Screw ass'y as shown in Fig. 5a. Tighten nut only until slack is out of Pin and Lever.

Measure and record dimensions D1, D2, and D3.

8.4 Adjust fixture ET-560000-ET-43-1 Figure 5b to provide D_2 dimension as determined in Paragraph 8.3. Place "locating rod" in pin groove at end of C.D.P. lever. Bolt flange and adjusting screw assembly to 560188 housing over the "locating rod" to maintain the D_2 dimension.

8.5 Measure and record width dimension (W_L) of C.D.P. lever at the nozzle metering location (see Figure 5b).

8.6 Install 558901 nozzles in servo housing without any shims. Using gage blocks, measure and record dimension (D_n) between nozzles (see Figure 5c).

8.7 Using formula, $T_{shim} = (W_L + .010) - D_n$, determine the total shim thickness (see Figures 5c and 5a).

8.8 Remove one of the 558901 nozzles. Measure and record dimension L_1 (see Figure 5d) back off, but do not remove opposite nozzle.

8.9 Attach assembly (ref. Paragraphs 8.2 and 8.4) to servo housing, use seal #69397A29. Apply approximately a 10 lb. load at radius "D" (ref. drawing 561924) of C.D.P. lever. (See Figure 5d)

8.10 Measure and record dimension L_2 in the nozzle housing. (See Figure 5d) Determine shim thickness required for this nozzle using formula Tshim = $(L_1 + .005) - L_2$.

Remove this shim thickness from total established in Paragraph 8.7, and reassemble with nozzle. Remove and reassemble opposite nozzle with the shim thickness remaining from total Tshim.

8.11 Remove lever assembly from servo housing and 560188 housing.

8.12 Assemble the motor bellows portion of sensing bellows set 553139 and adjusting screw 553138. Apply a net load of 2.0 lbs. as shown in Figure 5e, and set dimension (D_2 + .010 ± .0025) (ref. Paragraph 8.3). Pin 553137 must be aligned with one side of bellows flange. (See Figure 5e). Mark position of adjusting screw and bellows nut with pencil or crayon to insure proper alignment of final assembly. Use fixture ET-560000-ET-44.

8.13 Attach the evacuated bellows portion of sensing bellows set 553139 to above assembly (ref. Paragraph 8.12). Apply a 6.2 lbs. load as shown in Figure 5e, and set dimension $D_1 - D_2$ (ref. Paragraph 8.3). Mark position of adjusting screw and nut. (ref. Paragraph 8.12). Use fixture ET-560000-ET-44.

8.14 Install adjusted bellows sensing set (ref. Paragraph 8.12 and 8.13) into 560188 housing. Pin 553137 must be parallel to servo housing mounting surface.

Cautions Do not rotate evacuated bellows when bellows are being tightened down in housing. Measure and record dimensions C_2 and C_3 as shown in Figure 5f, using fixture ET-560000-ET-43-2. Determine dimension C_1 using formula $C_1 = C_3 - C_2$.

8.15 Determine shim thickness for "M" dimension as shown in Figure 5a, (ref. Paragraph 8.3) using formula Tshim = $D_3 - C_1$.

Note: Add Tshim to original shim valve if D_3 is larger than C_1.

Remove Tshim from the original shim valve if D_3 is smaller than C_1.

8.16 Attach 561924 lever and bracket to bellows sensing set and housing assembly (ref. Paragraph 8.14) using Tshim thickness determined in Paragraph 8.15.

8.17 Attach this assembly (ref. Paragraph 8.16) to servo housing.

8.18 Install CDP & Throttle Valve Transfer System Linkages.

8.18.1 Center CDP & T.V. Roller Push Rod Assemblies so that the center roller bearings do not interfere with the balance bar groove. Maintaining the bearings in this position, determine the shims required in the areas shown on Figures 32 & 33.

8.18.2 After shimming has been completed, move linkages to maximum end play position. Center roller bearing in either push rod assembly (CDP & T. V.) must not touch walls of balance bar groove over the full length travel on the balance bar.

9. Temperature T2 Washout Link (Ref. L-7208-14)

9.1 Obtain the dimension A from the Tt2 mounting face to the centerline of pin 69725-3036 in bracket 560013. (See Fig. 8).

9.2 With the power lever cam at its maximum radius obtain Dimension B, Tt2 housing mounting surface to the centerline of pin 69538A9-6 in lever 560024.

9.3 Shim between bracket 560013 and bracket 560028 with shims 560284.

9.4 Shim thickness = A - B.

10. Compressor bleed shift linkage (L-7208-13)

10.1 Assemble linkage as shown on fig. 7.

10.2 Set the multiplying lever parallel to the parting line of the servo hsg.

10.3 Obtain dimension A and from para. 8.10 HS-1509 fig. 5d obtain dimension B.

10.4 Shim thickness is S = A-B.
Place shims in location shown on figure 7.

10.5 Position CBA rollers at 1.625 ± .005 as shown on figure 26.

11. Pressure Regulating Valve Sensor - Peak and Inline (Ref. L-7208-116)

11.1 With the flapper system assembled outside the sensor housing.

Determine dimensions A, B, and C with the flapper closed as shown in Fig 14.

11.2 Shim under pin-ball 558869 with shims 515298.

11.3 Shim thickness A-(B+C) + .015.

12. Manifold Transfer System (L-7208-23)

12.1 Install 560000 Et-23 across hydraulic housing with 70 lb. force directed to the balance bar, locating the force balance bar (572547) in a horizontal position. With the balance bar in a horizontal position shim both nozzles to a .008 - .010 gap. See Fig. 10.

12.2 Install 560000 Et-24 across the hydraulic housing. Maintain the force balance bar (572547) in a horizontal position by installing .008 - .010 shim stock between nozzles and the force balance bar.

12.3 Utilizing 560000 ET-24 locate the centerline of the C.D.P. rollers .412 ± 002 from the centerline of pivot pin 579488 with the peak valve located at 30 psia ± K. With the rollers .750 from ℄ of pivot pin shim under bracket 560082 with shims 560098 until distance from the centerline of pin 69725-30-14 on CDP rollers is .205± 005 above the roller contact surface on the force balance bar.

12.4 Utilizing 560000 ET-24 locate the centerline of the T.V. rollers .358±002 from the centerline of pivot pin 579488 with the throttle valve set for a .014 window opening. See Figure 22. With the rollers .690 from ℄ of pivot, shim under bracket 576473 with shims 560099 until distance from centerline of pin 579488 on the throttle valve rollers is .208 ± 005 above the roller contact surface on the force balance bar. (See Fig. 11)

12.5 Shim under bracket 560088 with shims 560097 so links 560086 and 560013 will not dis-engage under extreme travel conditions. (See Figure 12)

12.6 Assembly transfer housing less power springs, adjusting screws and transfer valve, obtain dimension A from transfer housing face to L of power lever pin. (See Fig. 19).

12.6.1 With transfer linkage assembled in hydraulic housing obtain the Dimension "B" from the top of the rollers to the hydraulic housing mounting face. (Fig. 19). Shim under bracket 572553 and 572554 with shims 577935. Shim thickness =A-B.

13.0 Zone I Shut-Off Valve

13.1 Shimming Procedure

13.1.1 Obtain Dimension A on cap 558904 (See Fig. 18).

13.1.2 Install packing 69587A58, chevron 69588-58, ring 69586A58, and spacer 576445 into the housing as shown. With valve and seal held firmly against the bottom of the housing obtain readings at 90° intervals on the spacer. The readings should not vary more than .004.

13.1.3 The average reading is dimension B.

13.1.4 Shim between spacer and back-up ring (See Fig. 18). Shim thickness S = B-A (.002 to .004).

13.2 Springheight adjustment; ref. Sect. A-A, 573184.

13.2.1 Assemble the spring and retainer sub-assembly with nut 69765-3, in approximately correct position.

13.2.2 Install the sub-assembly (13.2.1) into the valve I.D.

13.2.3 Place cover 558904 on top of the outboard retainer. Push in lightly on cover to be sure that the valve is seated.

13.2.4 Measure the distance between the housing and the cover bolt flanges.

13.2.5 Adjust nut, 69765-3, until the distance (13.2.4) is .125 ± .020.

13.2.6 Complete assembly in accordance with the picture shown on Sect. A-A of 573184.

14. Temperature Servo Piston Roller Position

14.1 Obtain dimension from the temperature servo piston cap mounting surface on the linkage housing to the centerline of peak throttle valve bore. (Dimension B, See Fig. 13).

14.2 Install the temperature servo piston and 560000 Et-21, and 560000 Et-7. Position The servo piston until it is at -65°F. as indicated by the cam follower (560000 ET-7). With the piston held in this position obtain Dimension X.

14.3 Position rollers on the servo piston such that Dim. A = B -X - .745.

15. Temperature Servo

15.1 With levers 562050 and 562059 in line as shown on Fig. 15. Hold lever 560136 parallel to 562059 and shim under bracket 560138 until distance between 562059 and 560136 is .501 ± .001.

15.2 With levers held as in 15.1 shim nozzles 560129 for a .003 gap on each nozzle.

15.3 Shim under bellows assembly 574153 with shim 562054. Shim thickness (X + D - .130) -A ± .001. See Fig. 16 and 17.

15.4 Adjust stop screw 562055 until Dim. C = F - .300. See Fig. 17.

15.5 Final Stop Screw Adjustment.

15.5.1 Using a spring tester, determine the load at which the sensor's motor bellows reaches a null position (approx. 70-75 lbs.). See Fig. 29.

15.5.2 Install roller simulator between reduction and feedback levers. Install sensor with motor bellows (seal 69400A57 not to be used) in spring tester and apply null load. Position roller simulator until flapper is in null position between nozzles. See Fig. 30.

15.5.3 If a flapper null position cannot be attained, reset the set screw, 562055, $\frac{1}{4}$ turn CW or more and repeat 15.5.2.

15.5.4 If a flapper null position is attained, use shim stock to measure clearance between motor diaphragm and housing (dim. N).

15.5.5 Referring to Fig. 17, reduce "C" dim. by the amount of dim. N found in 15.5.4 so that motor diaphragm and hsg. are line on line in the loaded conditions.

16. Pump Control Piston (Ref. L-7208-112)

16.1 Shim under rack to position the pitch line on the centerline of the piston. See Fig. 23.

16.2 Obtain dim. A. O. D. of piston.

16.3 Position the lower piston rack until it is parallel to a referenced surface plate and obtain dim. B. using a .1150 dia. wire.

16.4 Shim under the rack with proper shims. Shim thickness = $(\frac{A}{2} + .068) - B \pm .001$

17. Zone II Shut-Off Valve and Peak Regulator Valve

17.1 Installation of Shim (See Fig. #24)

17.1.1 Obtain dimension "A" on cover 576441.

17.1.2 Assemble matched set 576447. (There is no shimming for recirculation or shut-off valves. Assemble them per drawing 573185 and para. 17.2)

17.1.3 Install packing 576396, seal 69588-56 and ring 576395 into housing. Obtain dimension "B" by taking readings at 90° intervals. These should not vary more than .004.

17.1.4 The average of these readings is dimension "B".

17.1.5 Shim below packing 576396 (See Fig. 24). Shim thickness is S=B-A-(.002 to .004).

17.1.6 Repeat 17.1.3 as a check of proper installation.

17.2 Spring height adjustment (Ref. Sect. A-A, drawing 573185).

17.2.1 Assemble the spring and retainer sub assembly (includes spacer 576437) with the nut, 69765-3, in approximately the correct position.

17.2.2 Install the shut-off valve into housing as in Sect. A-A, drawing 573185.

17.2.3 Install the sub-assembly (17.2.1) into the valve I.D.

17.2.4 Place cover 576438 on top of the outboard retainer. Press lightly on cover to be sure that the valve is seated.

17.2.5 Measure the distance between the housing and the cover bolt flanges.

17.2.6 Adjust nut, 69765-3, until the distance (17.2.5) is .125 ± .020.

17.2.7 Complete assembly in accordance with the picture shown on Sect. A-A of 573185.

18. Peak Valve Sleeve and Chevrons

18.1 Assemble seals, retainers, and spacer on peak valve sleeve and install sleeve in cover. Slide spacer and seals tight against sleeve stop and measure gap between spacer and cover. See Fig. 27.

18.2 From measurement obtained in 18.1 subtract .003 and add this amount of shims between spacer and cover.

18.3 Check end play after shimming. It must be between .002 - .004.

APPENDIX O

PART NAME	LENGTH OF STROKE
1. Peak Throttle Valve	1.5 Min from bottomed position
2. Cam Shaft & Ends With Piston Ring	1.5 Min from top of bore
3. Pump Control	
a. Main Piston	1.4 Min from bottomed position
b. Intermediate Piston	.3 Min from top of housing
c. Pilot Valve	.4 Min from bottomed position
4. Throttle Operated Pilot Valve	
5. Transfer System	
a. Piston (InL&H Hsg.)	.5 Min from bottomed position
b. Transfer Valve	.5 Min from bottomed position
6. PL Servo Pilot Valve	.5 Min from stop-pin
7. PL Servo Piston (with Piston Rings)	.9 Min from bottomed position
8. Time Delay Valve	.3 Min from bottomed position
9. Speed Signal Valve (Upper & Lower)	.4 Min from bottomed position
10. PRV Sensor and Peak Sensor	.25 Min from top of sleeve
11. Inline PRV	.4 Min from bottomed position
12. Main T.V. (Install in Hsg. with Cover)	Stop to Stop
13. Zone I SOV	.4 Min from window end of sleeve
14. Zone II Valves	
a. Recirculation	.4 Min from window end of sleeve
b. PRV & SOV	.4 Min from window end of sleeve
c. Ref. Valve	.4 Min from top of sleeve
15. Tt2 Piston (With Piston Rings)	From Piston Ring Chamfer to Bottomed Position

Appendix H

	(PSIA) PB	Conditions	Total PPH Wf Limits	PPH Peak Wf Limits
1)	60	(Tt2 = -65°F B.C.)	22300-24700	13100-14500
	150	PLA = 120°	54800-60600	32700-36300
2)	40	(Tt2 = -65°F B.C.)	3230-3570	
	200	PLA = 68°	16150-17850	
3)	30	Transfer per para. 14.5.2	7920-8760	
	150		39600-43800	
4)	18	(Tt2 = 150°F B.C.)	5560-6160	
	150	PLA = 120°	46400-51400	

L-7208-10 T.V. ROLLER LINKAGE
SHIMMING PROCEDURE

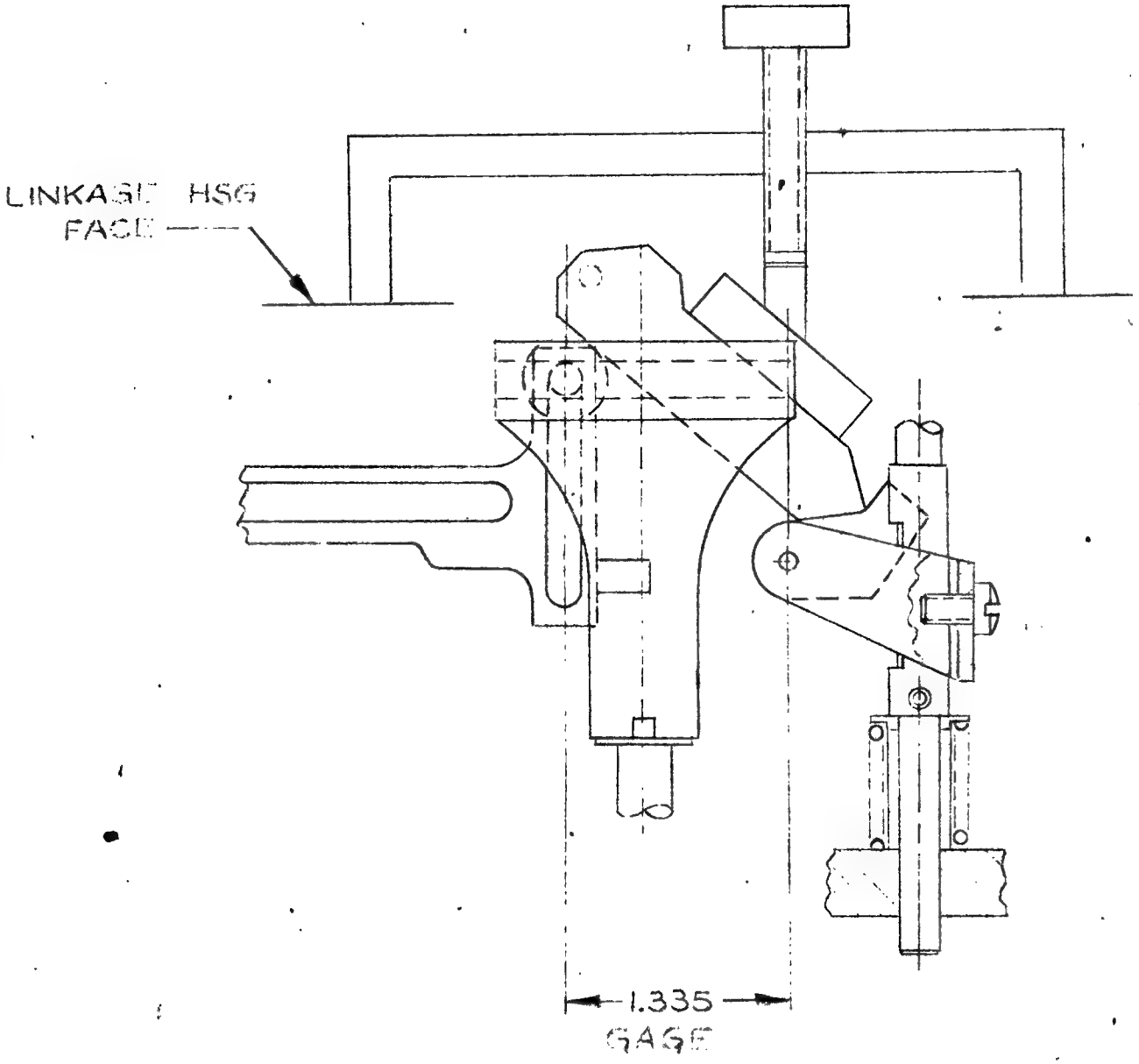
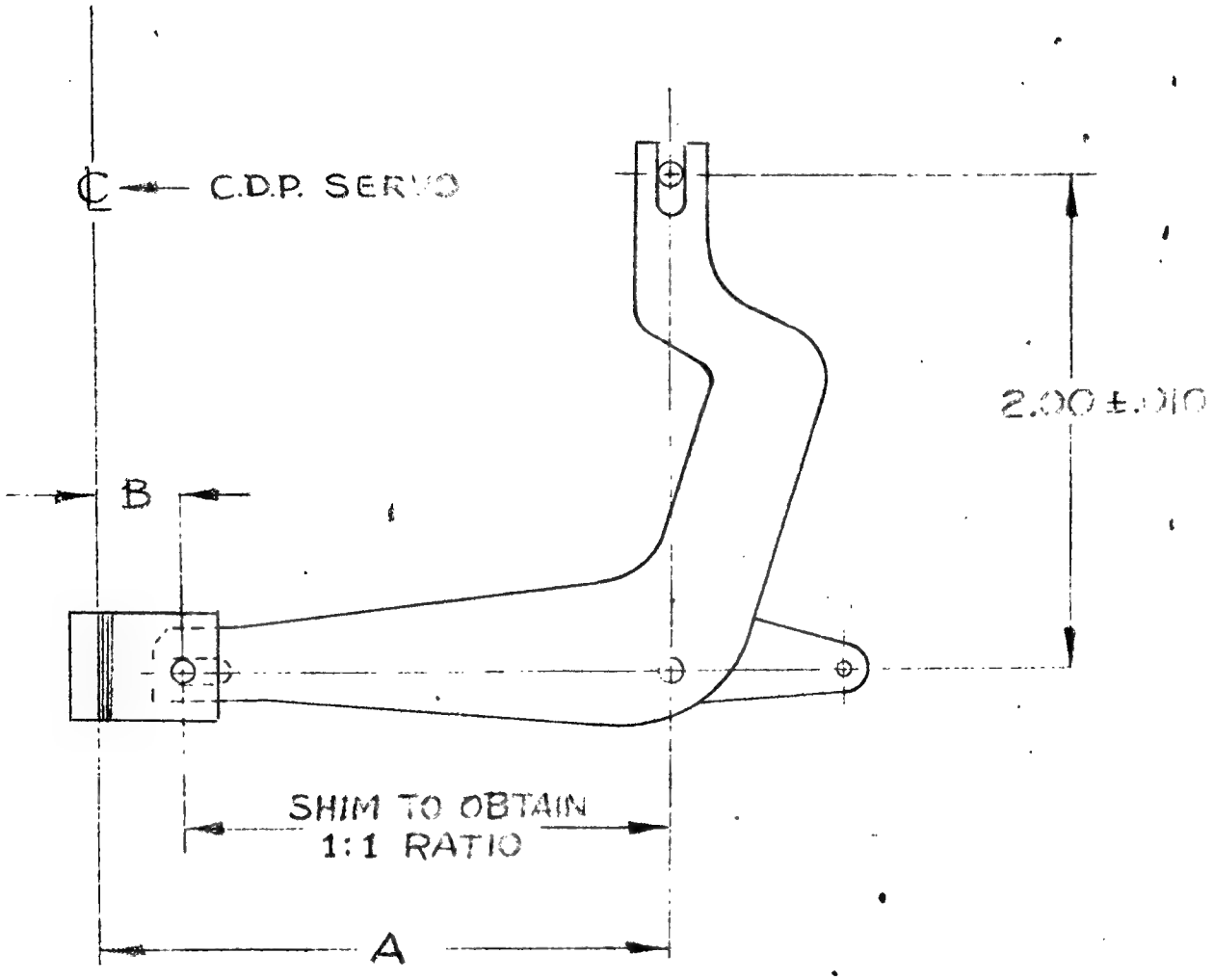


FIGURE 2

L-7208-10 T.V. ROLLER LINKAGE

SHIM TO OBTAIN 1:1 RATIO

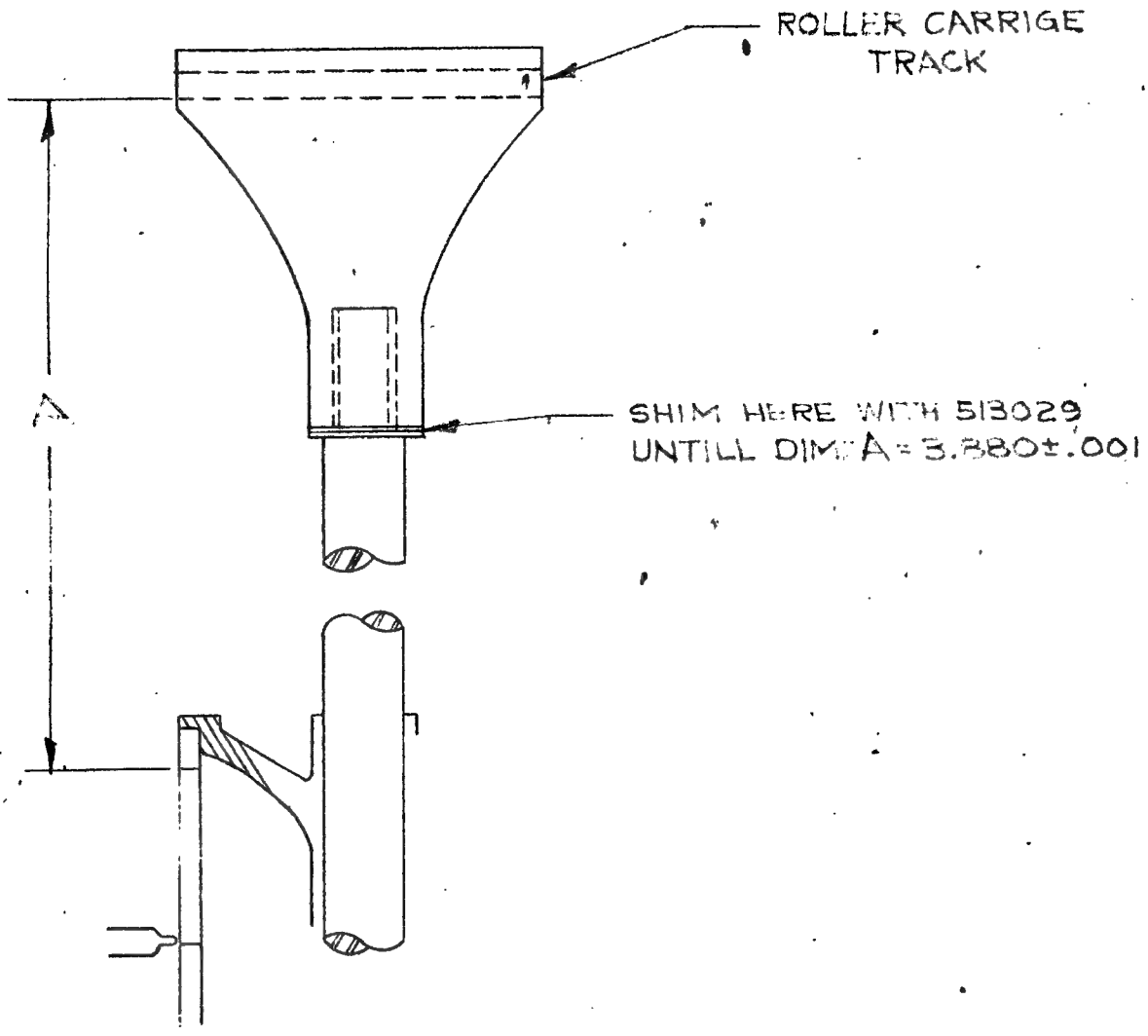


SHIM THICKNESS = A − B − 2.00

USE 2.00" RATHER THAN MEASURING ACTUAL 2.00±.010 DIM.; ERROR IN LEVER RATIO WILL BE INSIGNIFICANT. INSTEAD OF 1:1 RATIO WILL BE 1:1.01

FIGURE 2

L-7208-10 T.V. LINKAGE



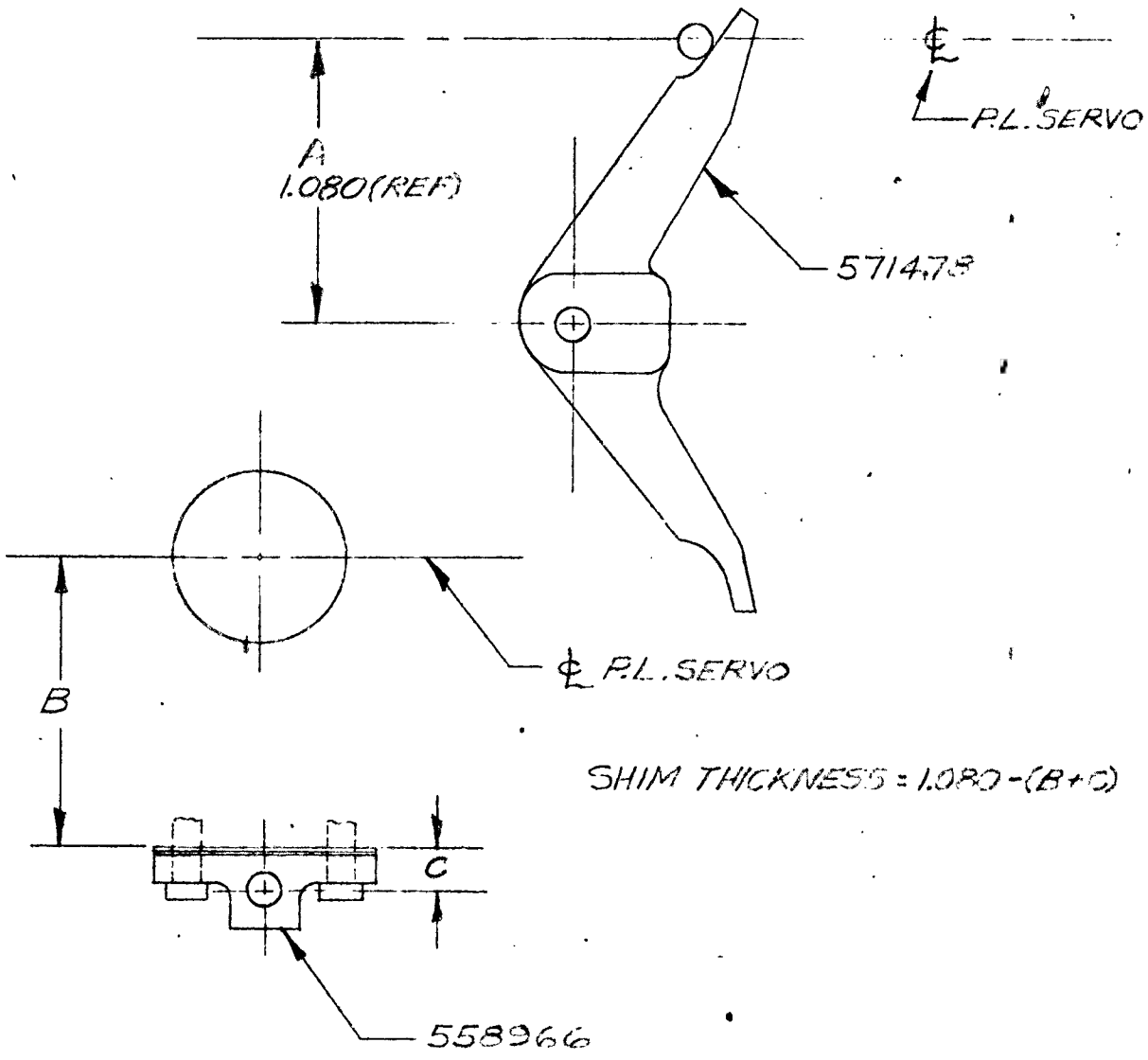
SHIM THICKNESS = A ± 3.880

FIGURE 3

FIGURE 4

L-7208-10 T.V. ROLLER LINKAGE

(SET CORRECT RATE BETWEEN P.L. SERVO & T.V. MULTIPLEXER)



SHIM THICKNESS = 1.080 - (B+C)

FIGURE 4

HAMILTON STANDARD

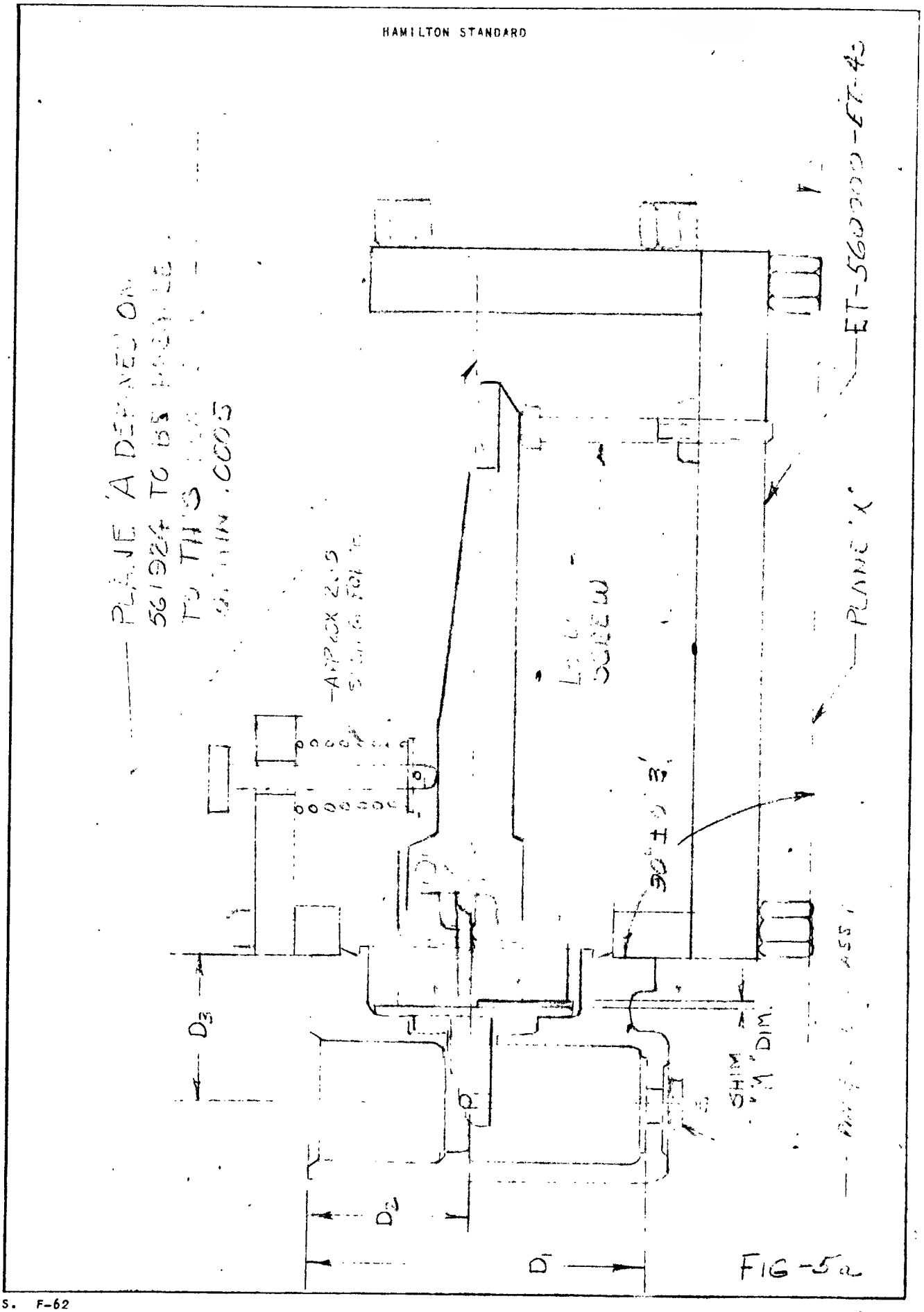


FIG-5a

HAMILTON STANDARD

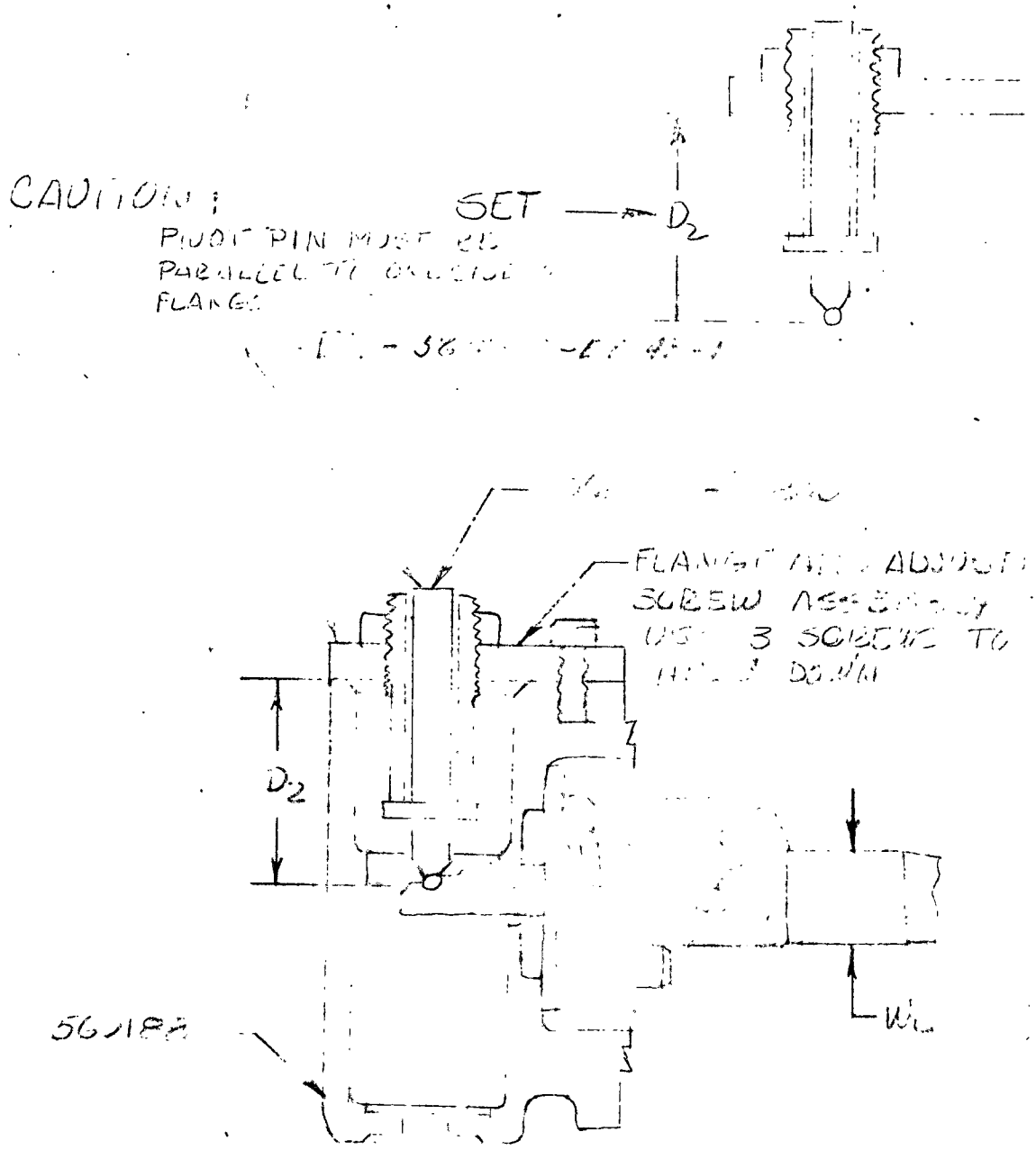


FIG-5A

HAMILTON STANDARD

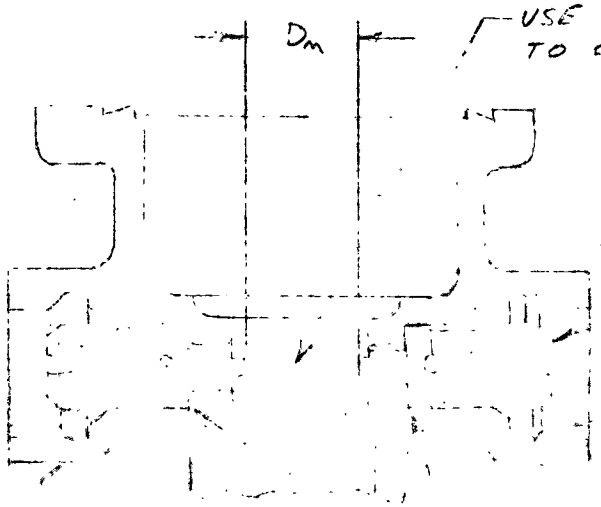


FIG -5c

HAMILTON STANDARD

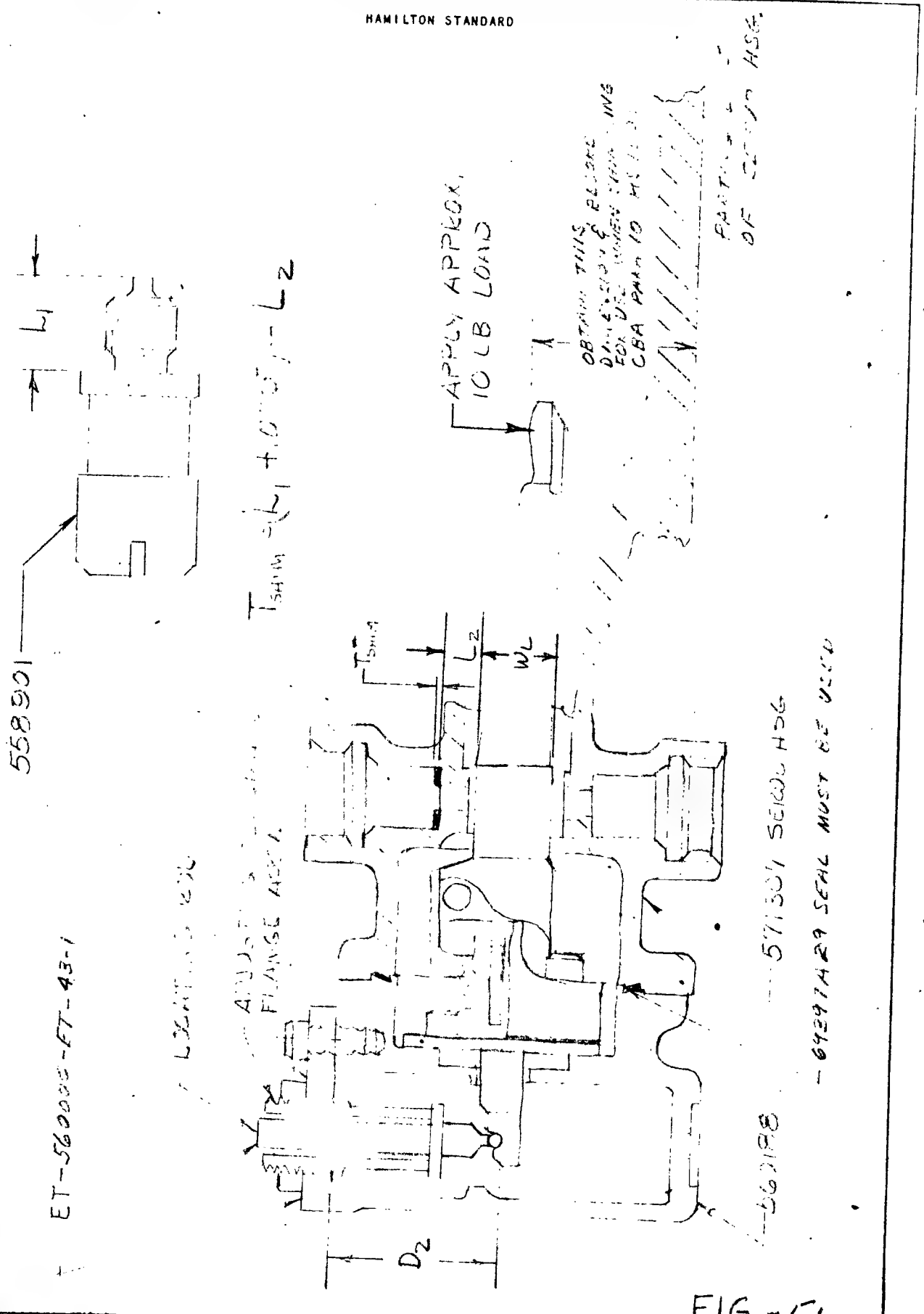
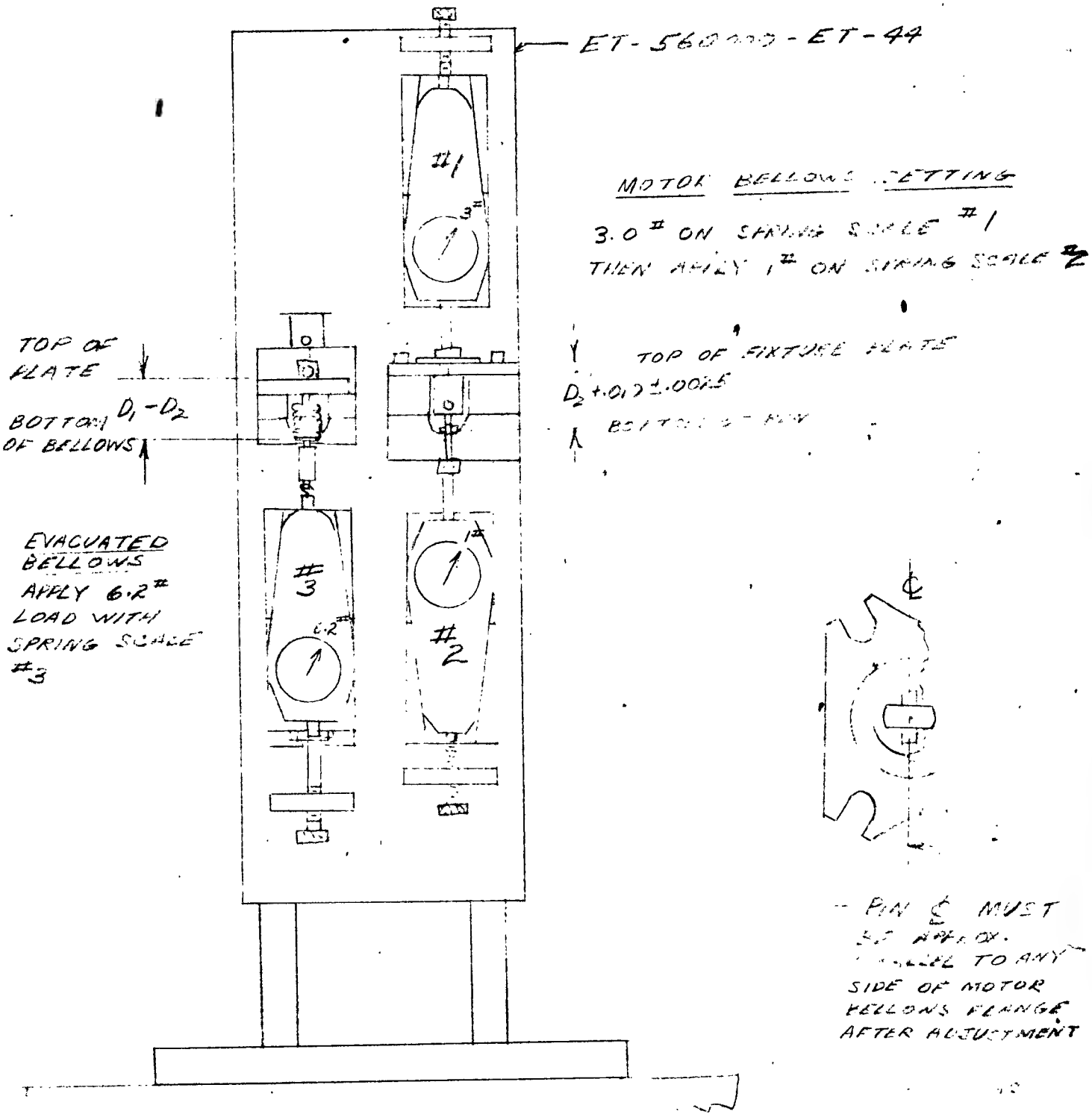


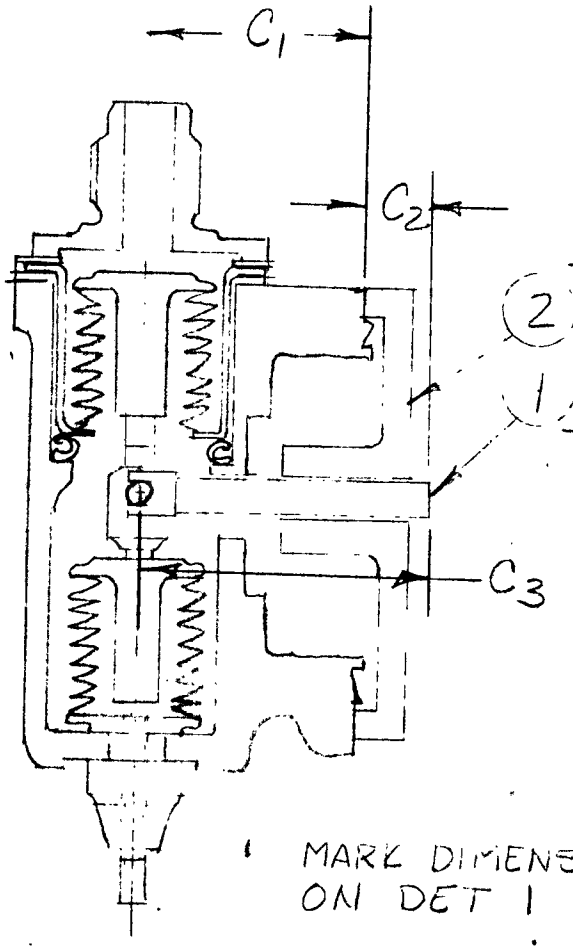
FIG. -5d



AFTER MAKING SETTINGS [illegible] PIN & BELLOWS TO INDICATE PROPER [illegible]

FIG.-5e

HAMILTON STANDARD



MARK DIMENSION C_3-(GAGE) ON DET 1

$$C_1 = C_3 - C_2$$

FIG. -5

FIGURE 6

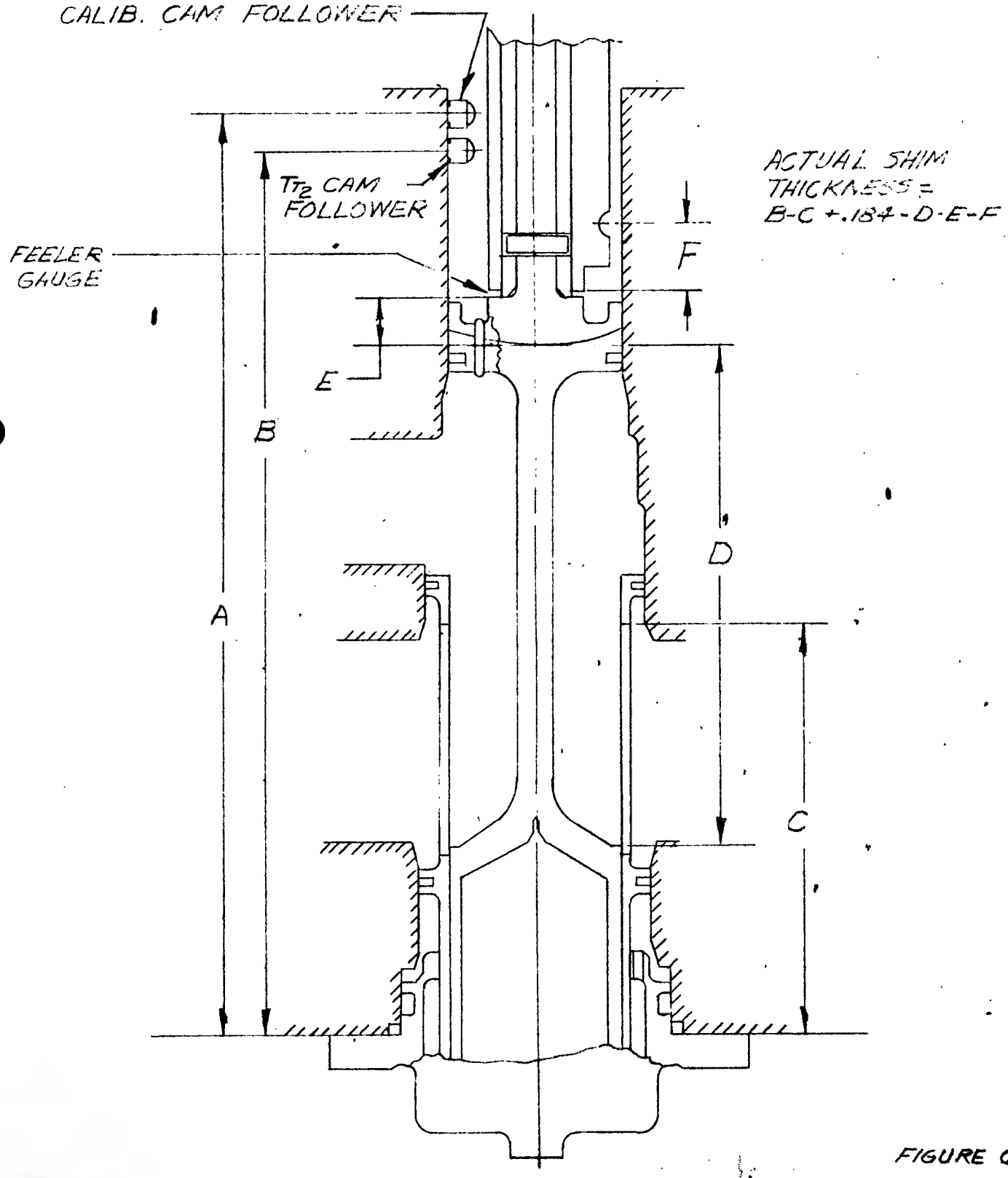
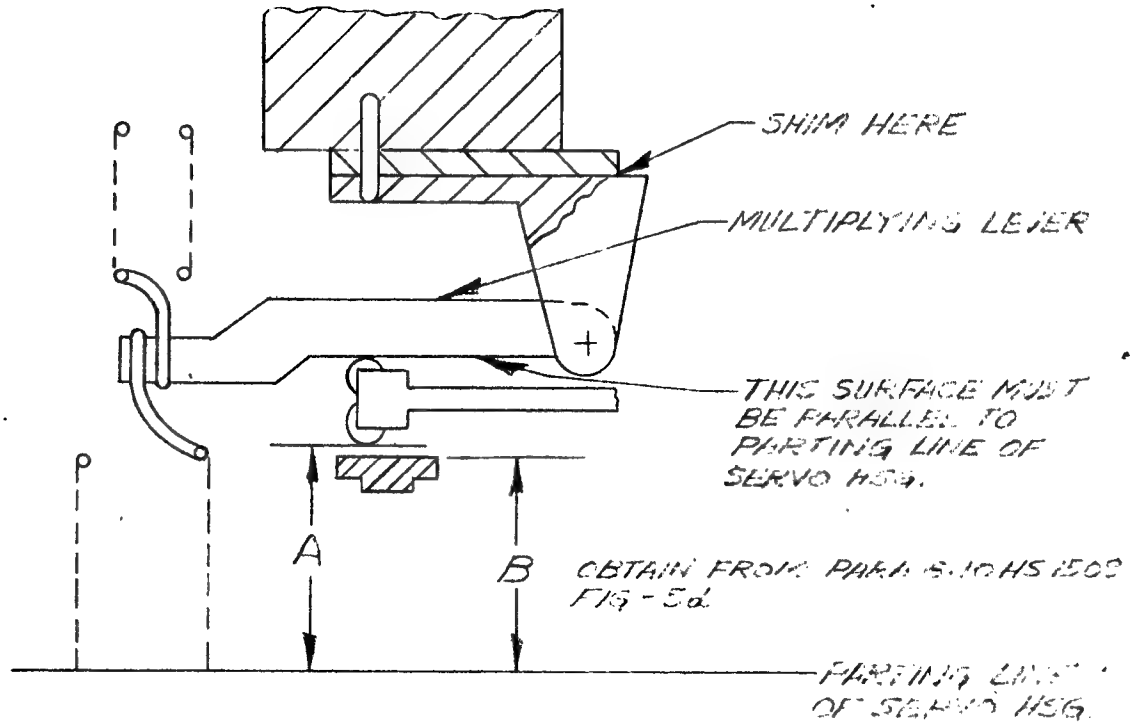


FIGURE 6

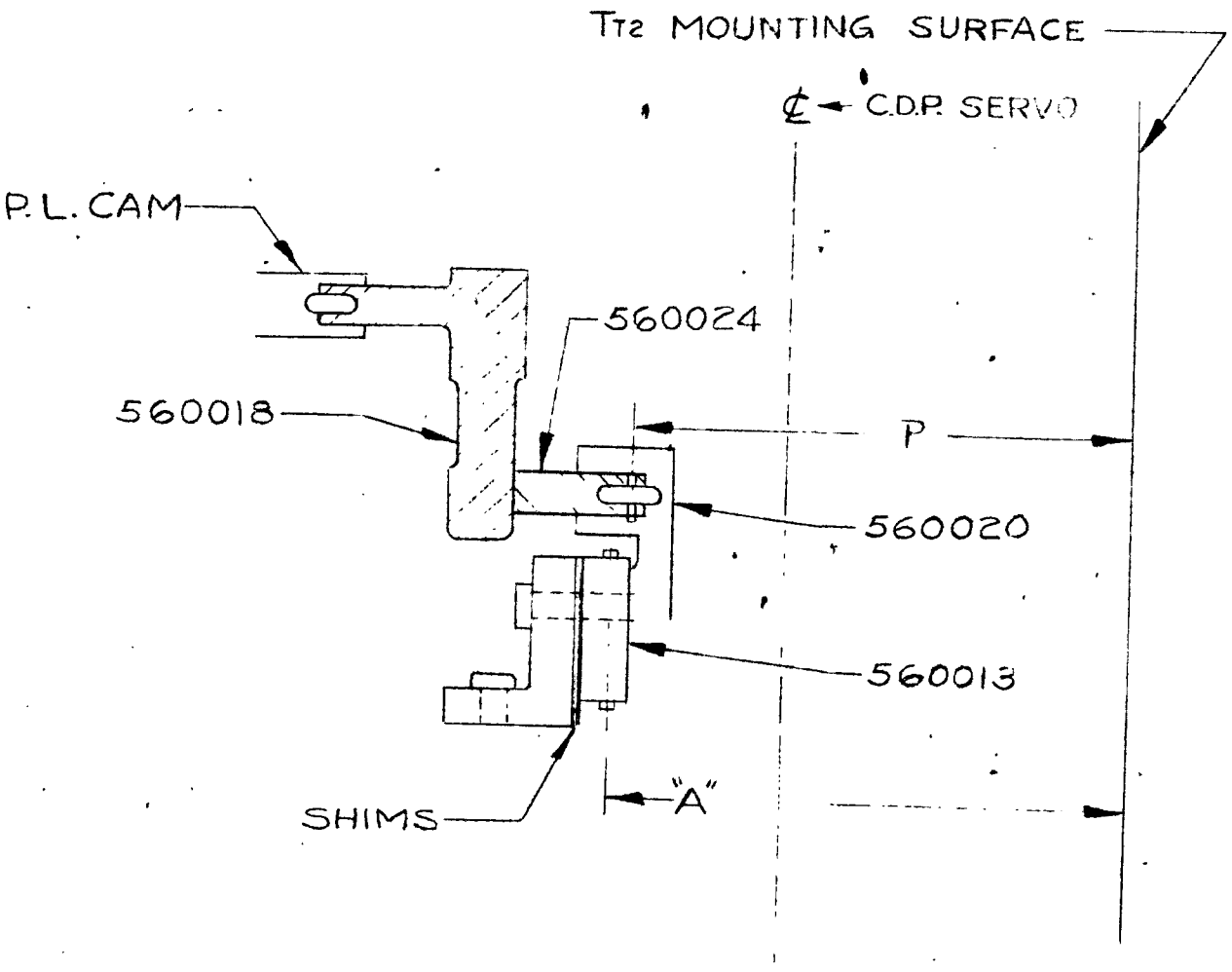
L-720-3-13 C.B.A. LINKAGE



SHIM = A-B

REV. 3-30-62
FIG-7

L-7208-14 P. L. LINKAGE

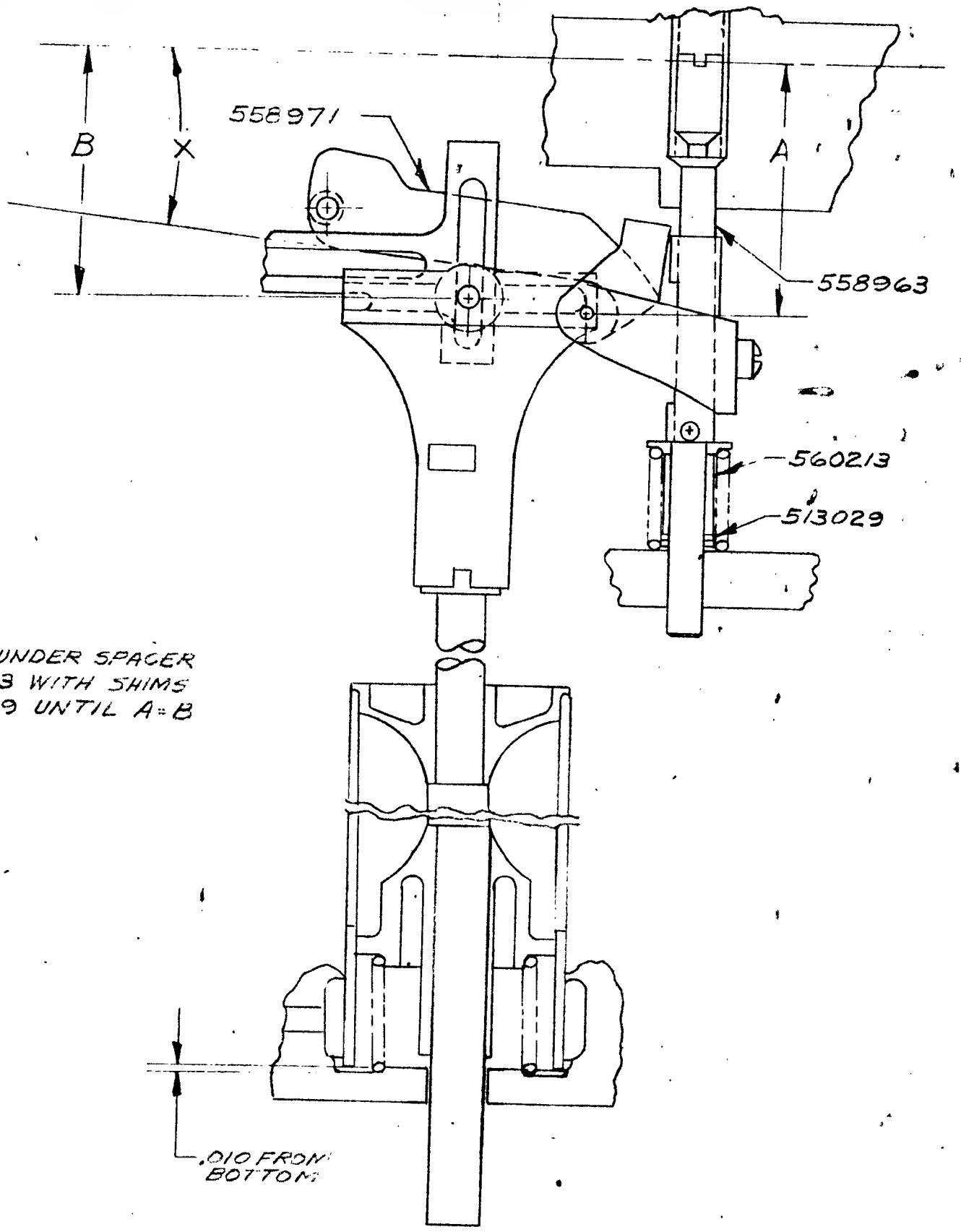


POWER LEVER CAM TO BE AT MAX. RAD
WHEN MEASURING DIM. "B"
SHIM THICKNESS = A-B

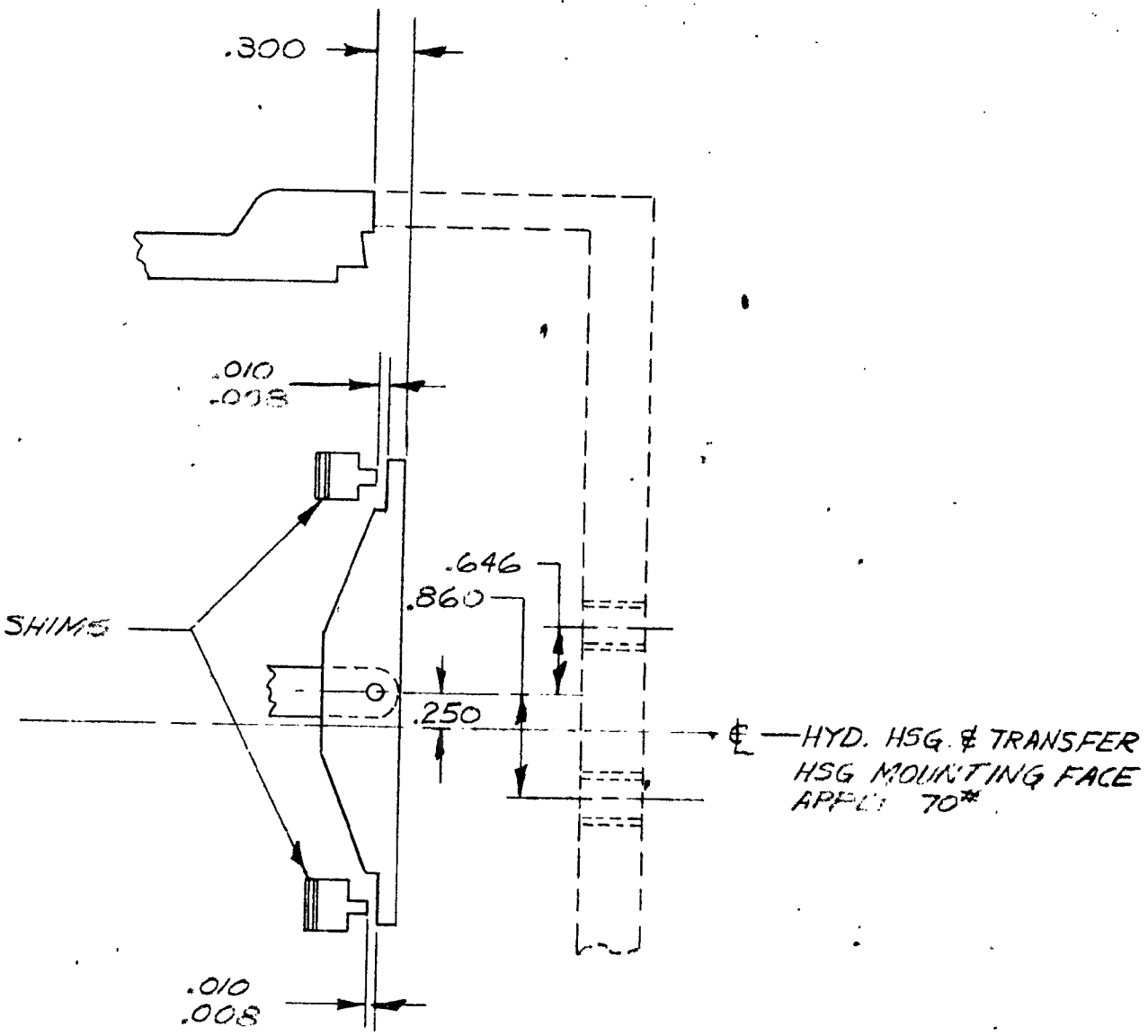
FIGURE 8

THROTTLE VALVE LINKAGE

CODE 73030

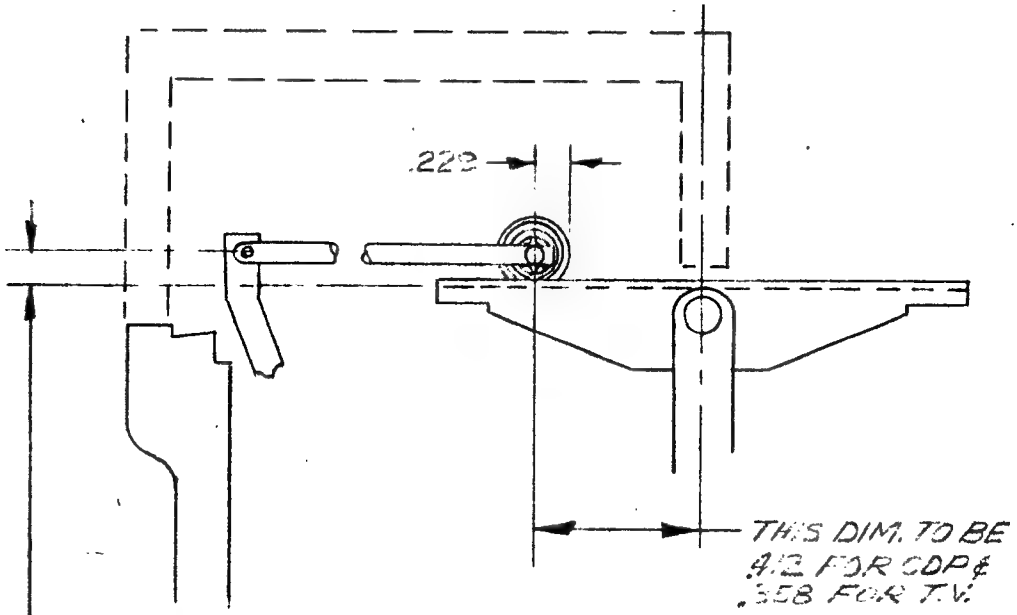


L-7205-23 ZONE II TRANSFER



SHIM UNDER NOZZLES TO OBTAIN .008-.010 GAP

ZONE II TRANSFER

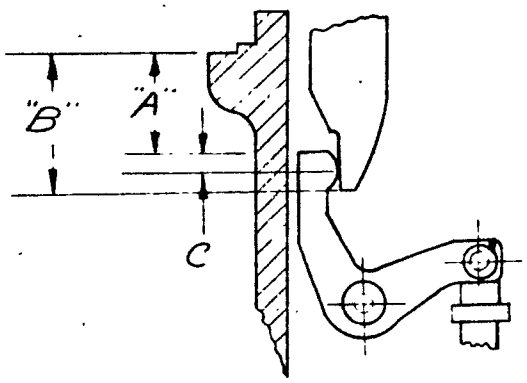


NOTE:

WHEN SETTING PIVOT TO ROLLER DIM. SET CDP SYSTEM SUCH THAT THE 3-D CAM BALL FOLLOWER IS IN THE 30 PSIA DETENT FOR CDP ROLLERS AND SET T.V. .014 OPEN WHEN SETTING T.V. ROLLERS

REV. 5-18-62
FIGURE 11

TRANSFER LINKAGE



SHIM UNTIL DIM "B" IS EQUAL TO OR GREATER THAN DIM "A" + C

FIGURE 12

L-7208-28 T_{T2} SERVO

ADJUST POSITION OF ROLLERS SO THAT AT PISTON POSITION FOR -65°F DIM. "A" = "B" - "X" = .745
DIM. "B" TO BE DETERMINED DURING INSP.

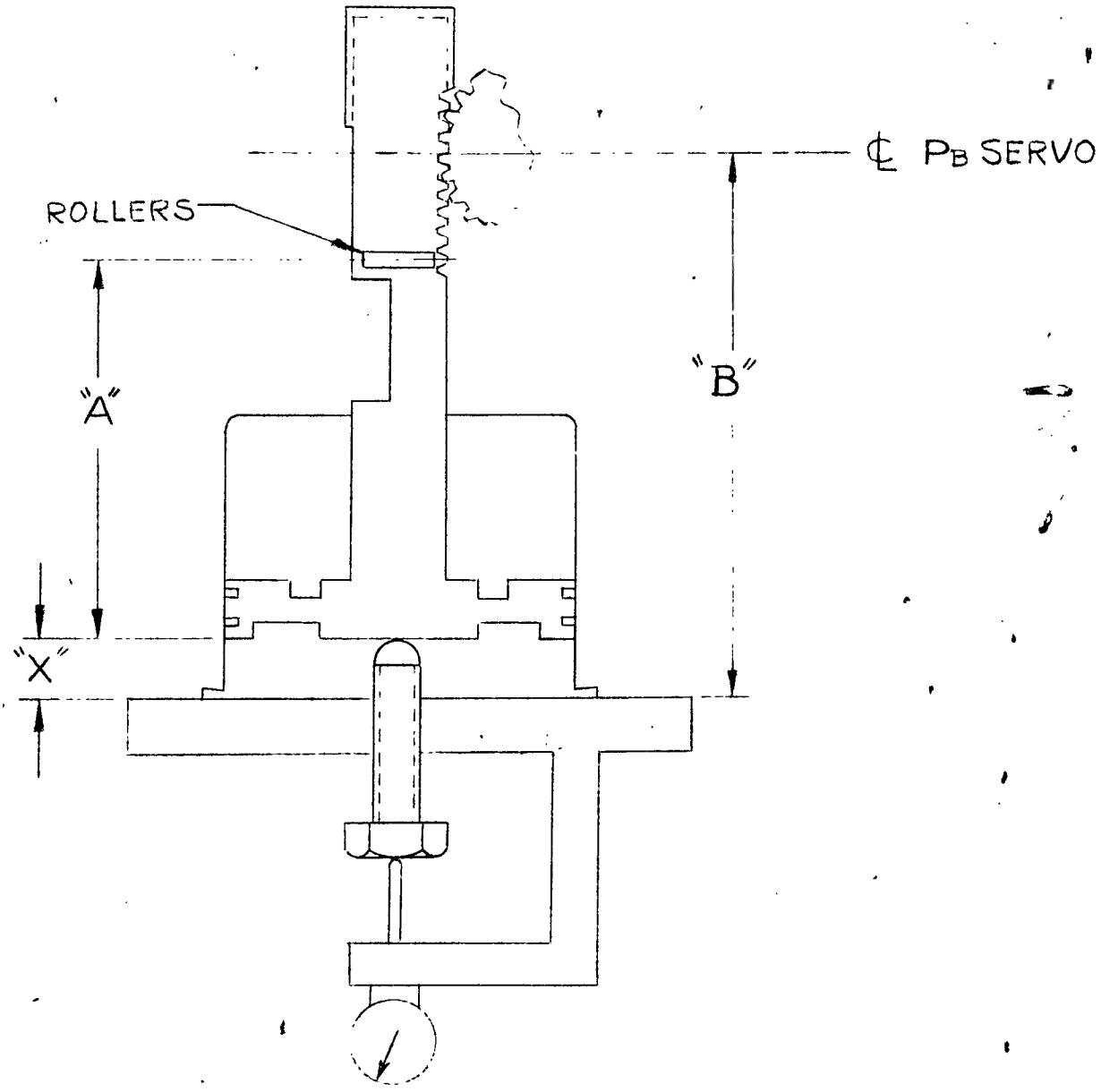
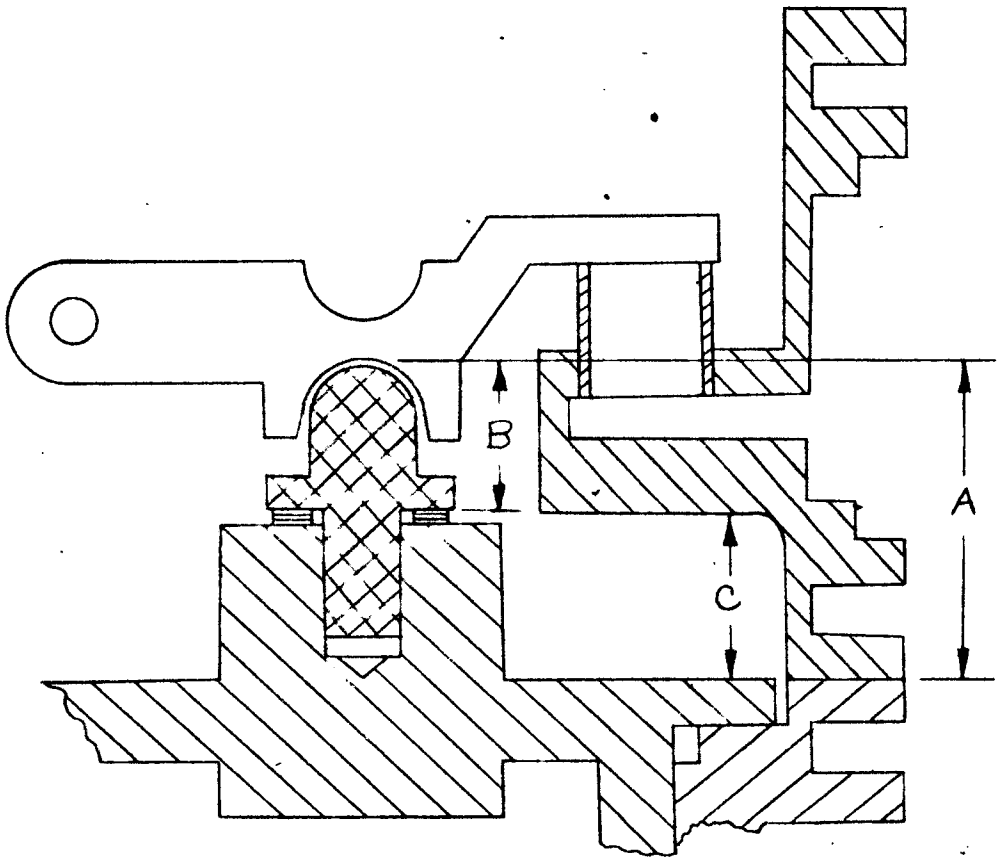


FIGURE 13.

JFC-51
SHIMMING PROCEDURE
PRESS. REG VALVE
SENSOR

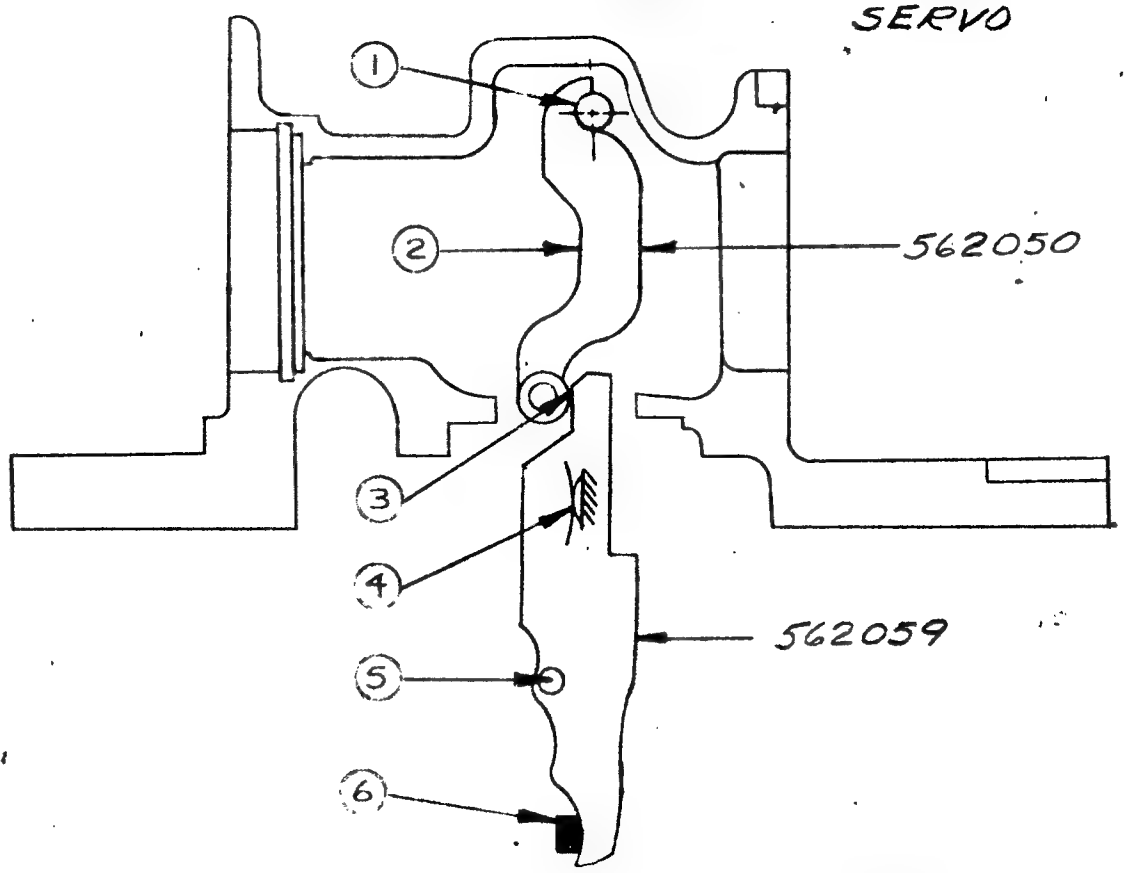


SHIMMING

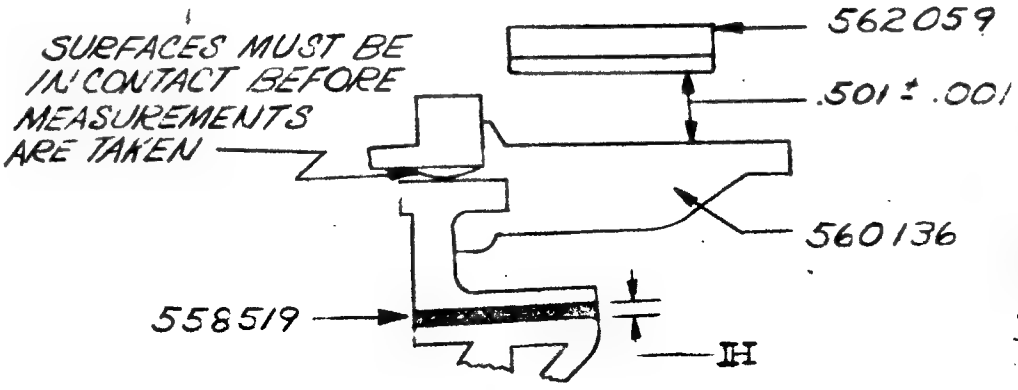
SHIM USED	REQ'D SHIM THICKNESS	SHIM ACT.	ASS'Y	INSP
515295	X=[A-(B+C)]+.015			

FIGURE 14

TEMPERATURE SENSING SERVO



SET UP LEVERS 562050 AND 562059 TO BE IN LINE AT POINTS ①, ②, ③, ④, ⑤ AND ⑥



WITH 562059 SET AT ABOVE POSITION ADD SHIM 558519 UNDER BRACKET 560138 SO THAT .501 DIM IS OBTAINED WHEN LEVER 562059 AND LEVER 560138 ARE PARALLEL

FIGURE 15

SHIM NOZZLES FOR .003 NULL GAP

CODE 73030

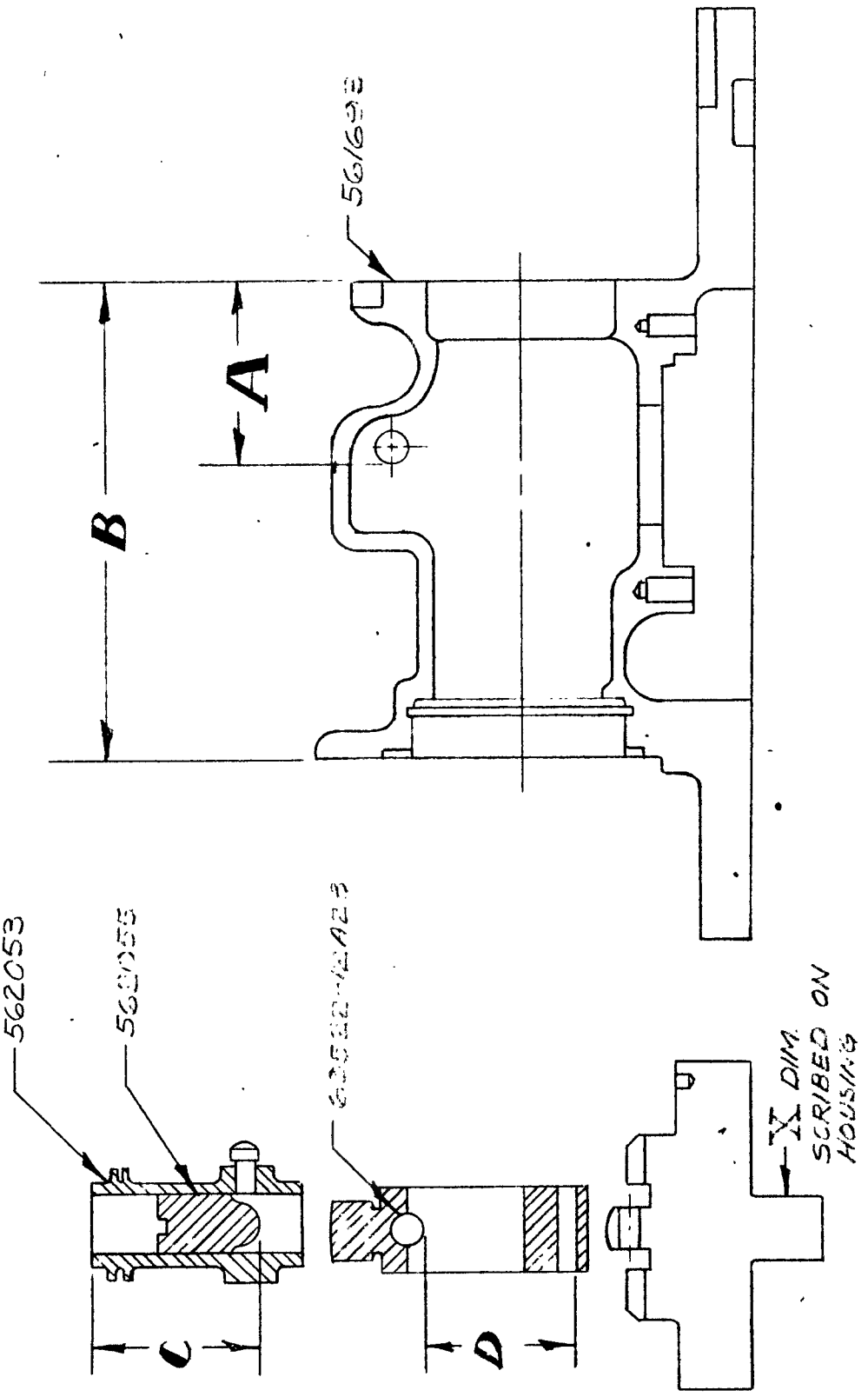


FIGURE 16

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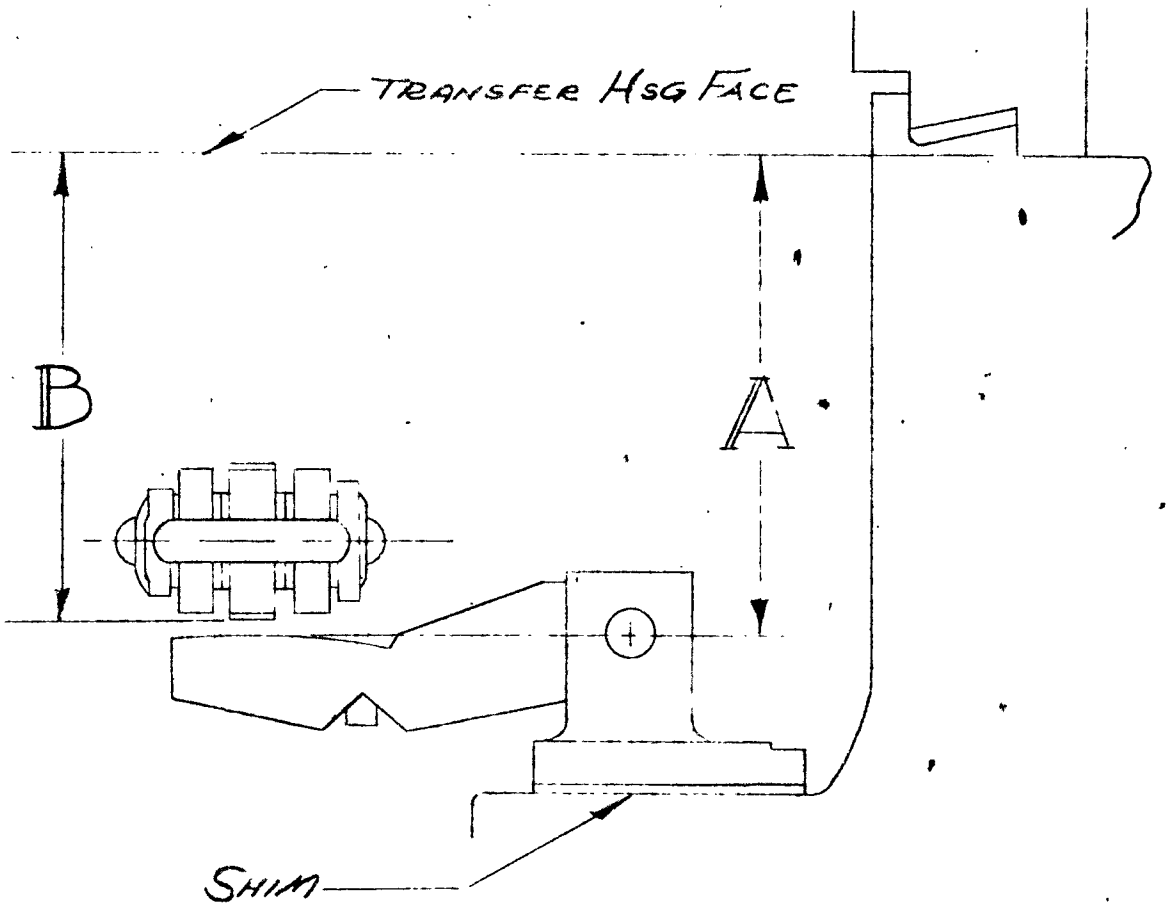
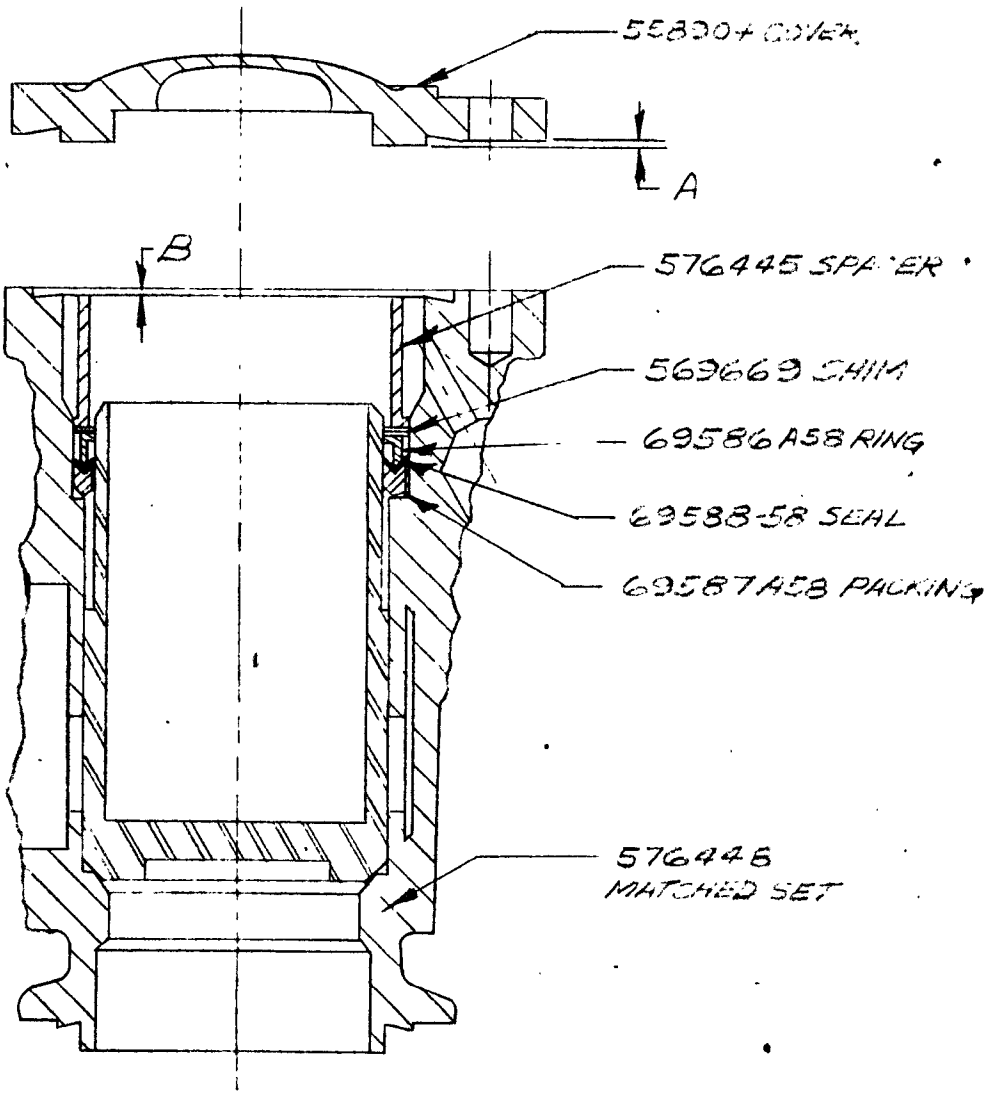
CODE IDENT. NO. 73030



SHIM THICKNESS = A - B ± .002

FIG-19

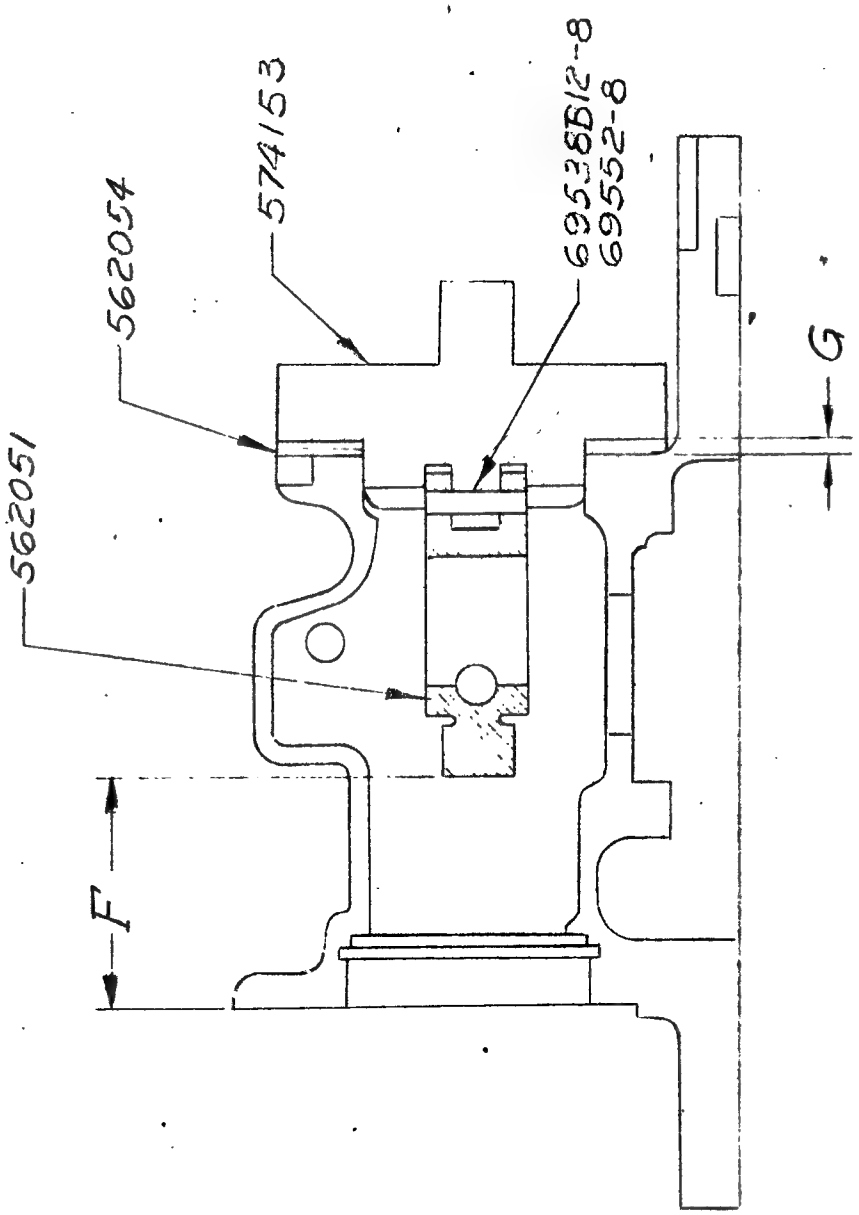
SHIM INSTRUCTION FOR ZONE-I



SHIM = B-A-(.002 TO.004)

FIGURE 18

TEMPERATURE SENSING SERVO



NO SHIM "G" 562054 = [X + D − .130] − A ± .001
"C" DIM. = "F" − .300

C.D.P. SENSOR & OUTPUT LEVER

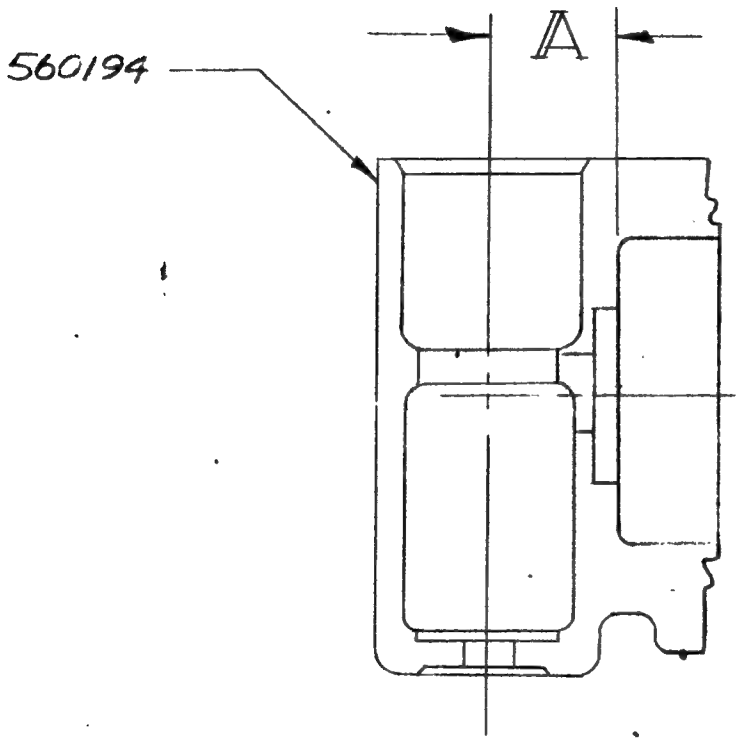
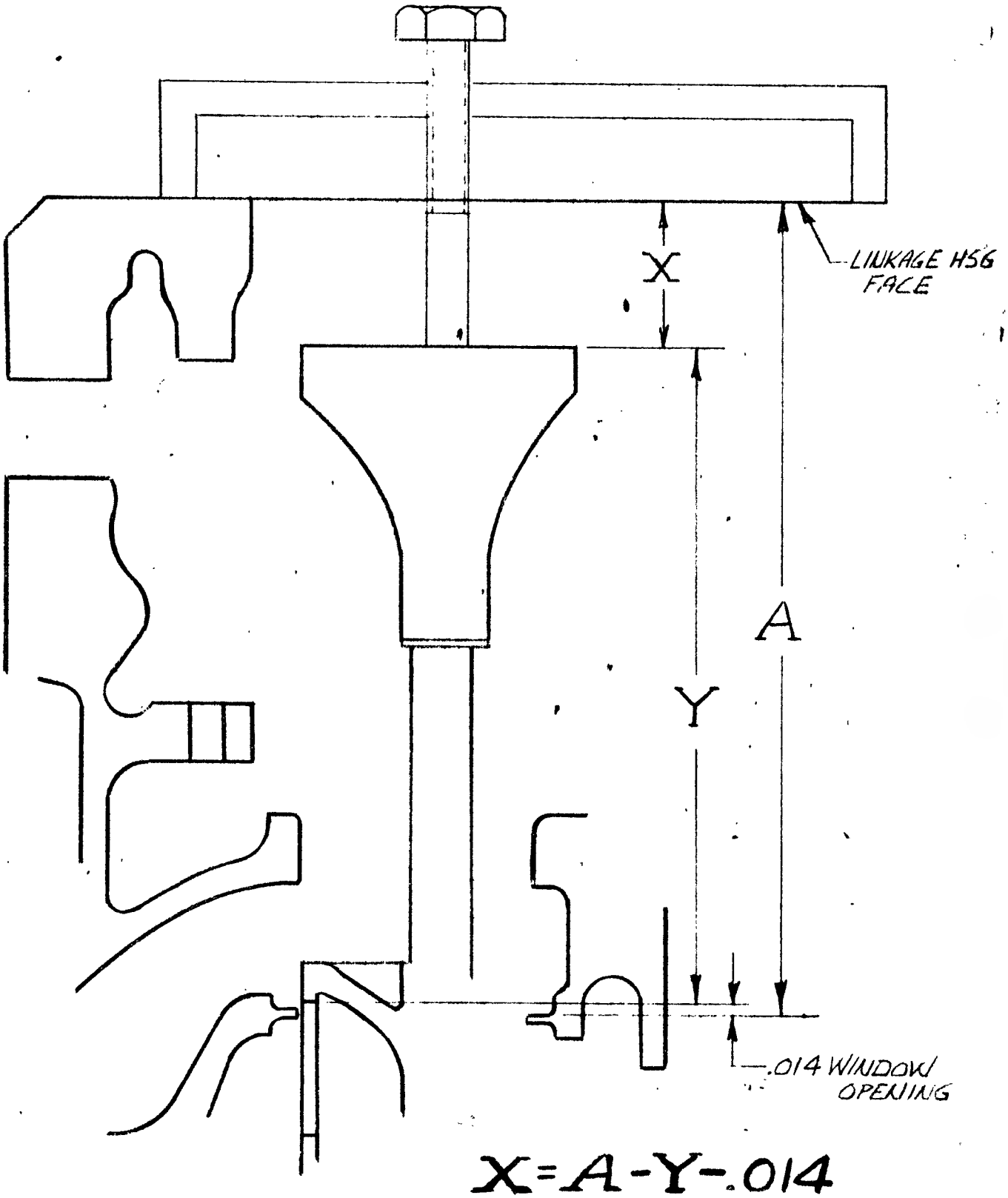


FIG. 20

L-1203-23 TRANSFER ROLLER SHIMMING PROCEDURE

FIGURE 22



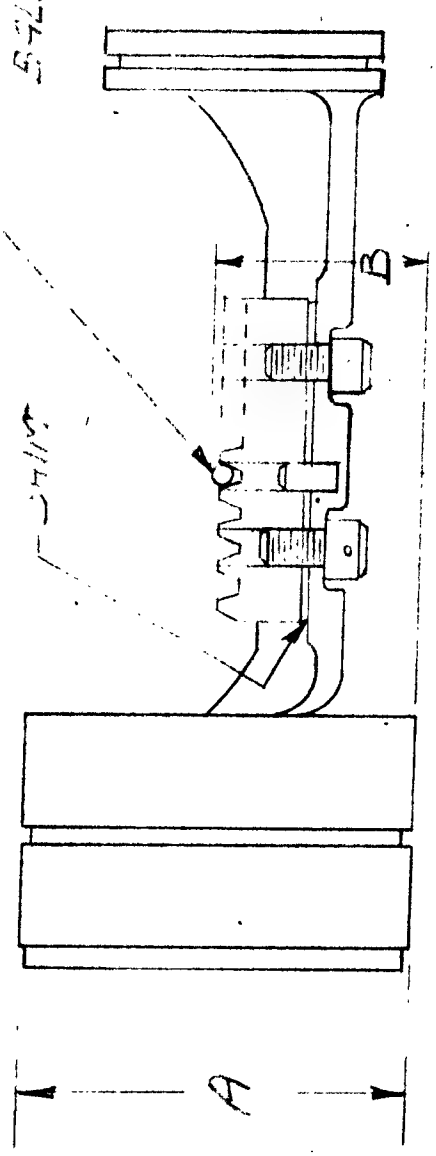
$X = A - Y - .014$

FIG. 22

FIGURE 23

L-7203-112 TWO PIECE PUMP CONTROL POWER PISTON

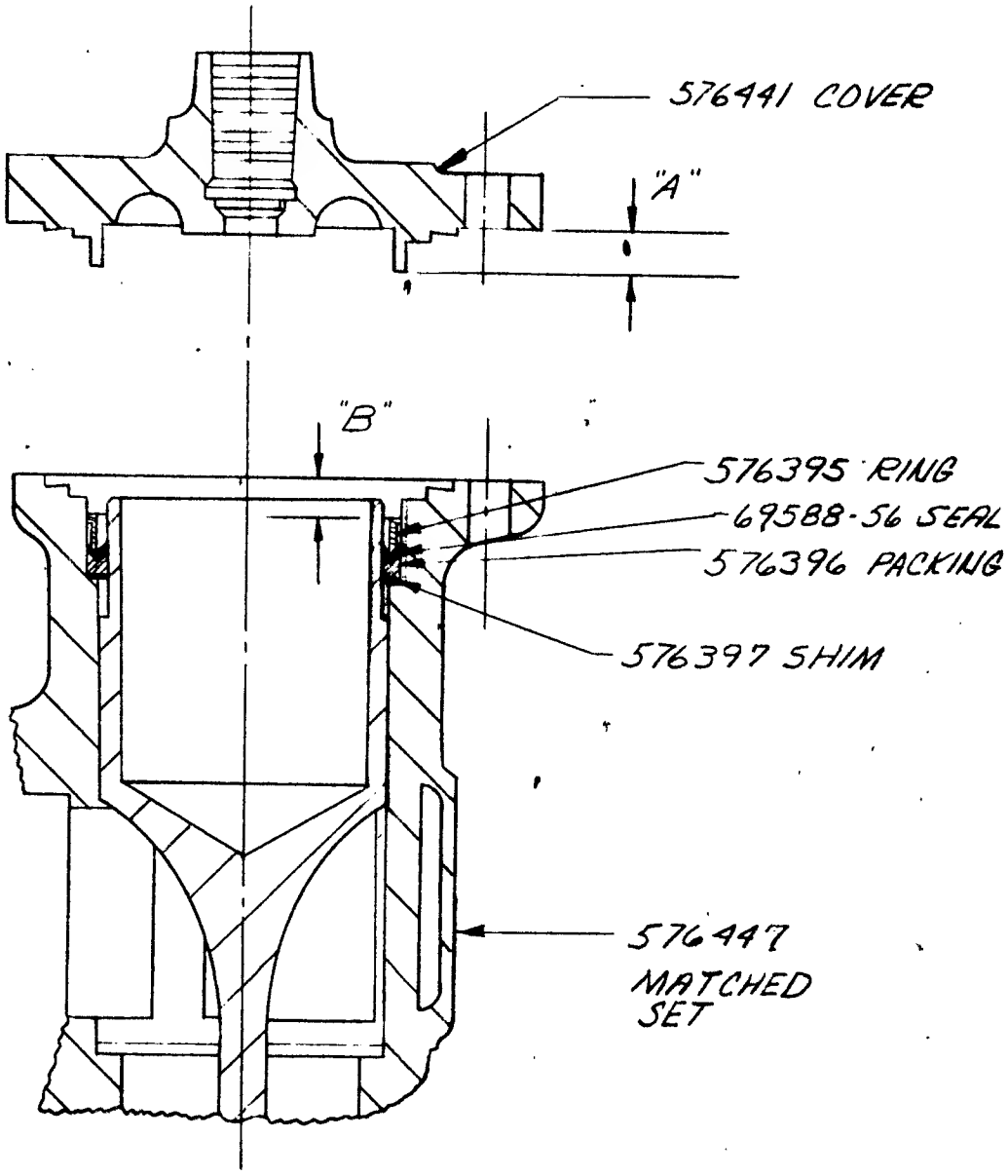
1150 MEDIUM NO. 46 GRIT STEEL SHOT PEENED



SHIM = $\left(\frac{A}{2} \pm .003\right) - B \pm .001$

FIG. 23

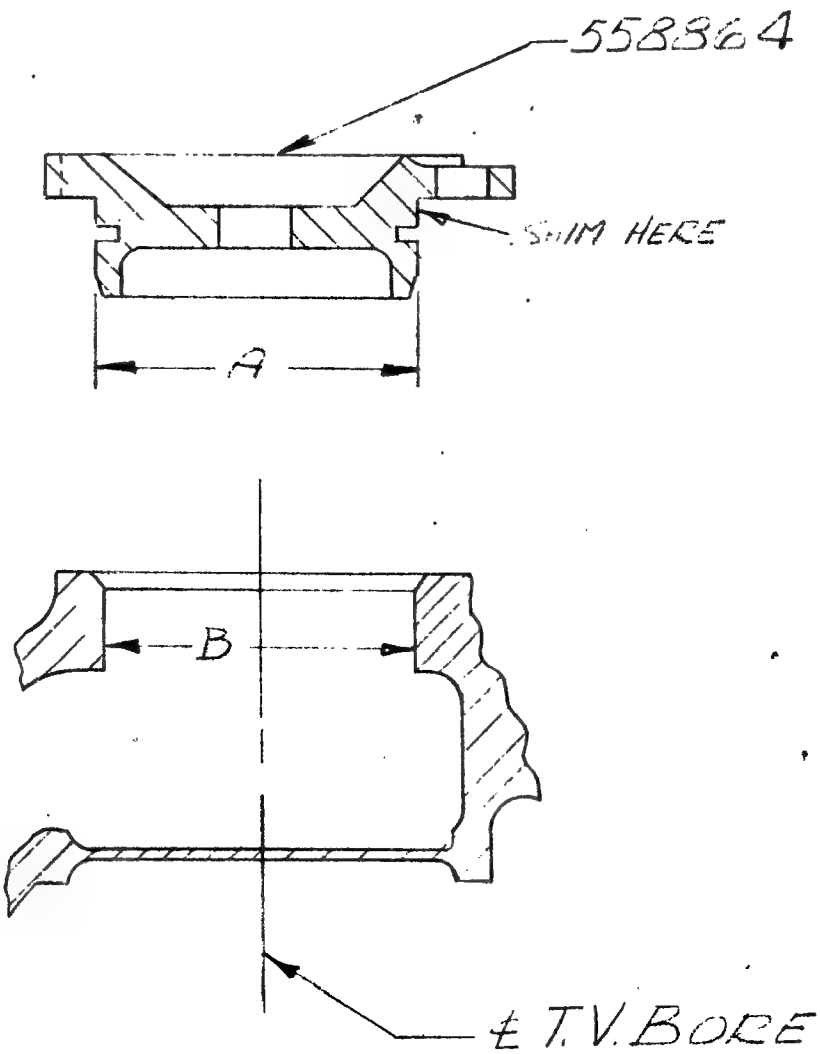
SHIM INSTRUCTIONS FOR ZONE II



SHIM = B-A-(.002 TO .004)

FIGURE 24

T.V. COVER



SHIM THICKNESS = $\frac{B-A}{2}$

USE SHIM 574113

FIG. 25

FIGURE 26

L-7208-13 CBA LINKAGE

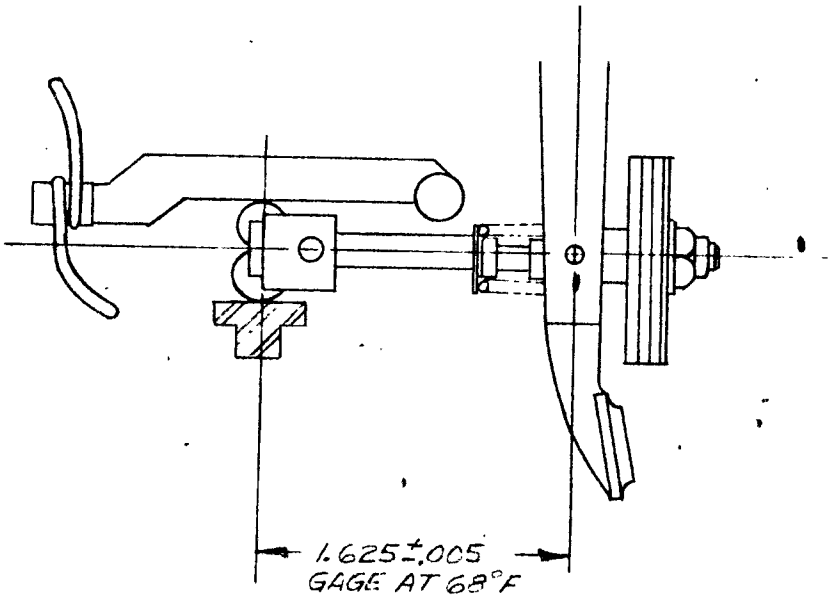
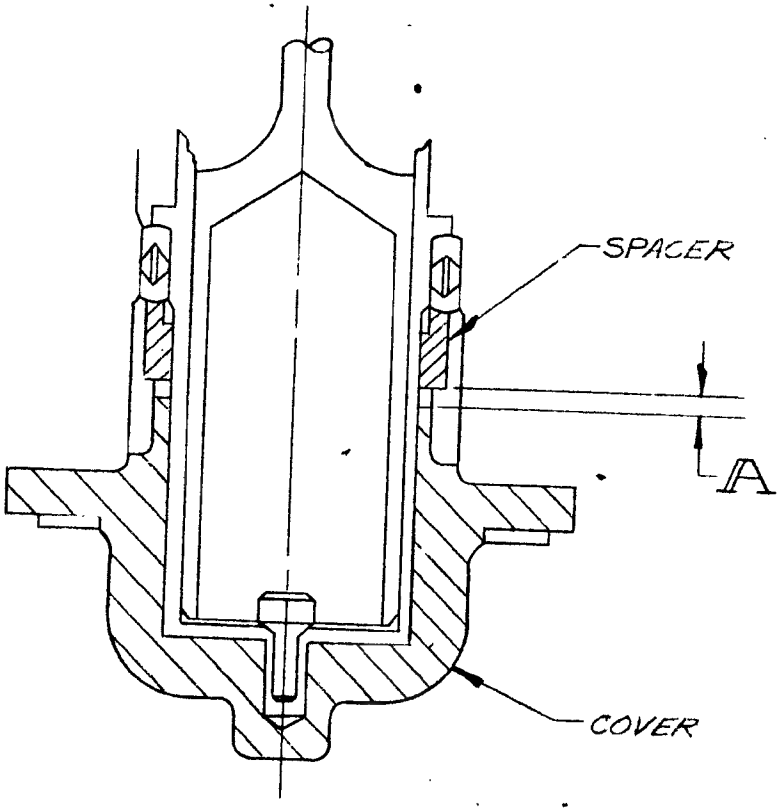


FIGURE 26

FIGURE 27

L-7208-96R

PEAK VALVE SLEEVE AND CHEVRONS



"A" = .003 = AMOUNT OF SHIMS BETWEEN SPACER & COVER

FIGURE 28

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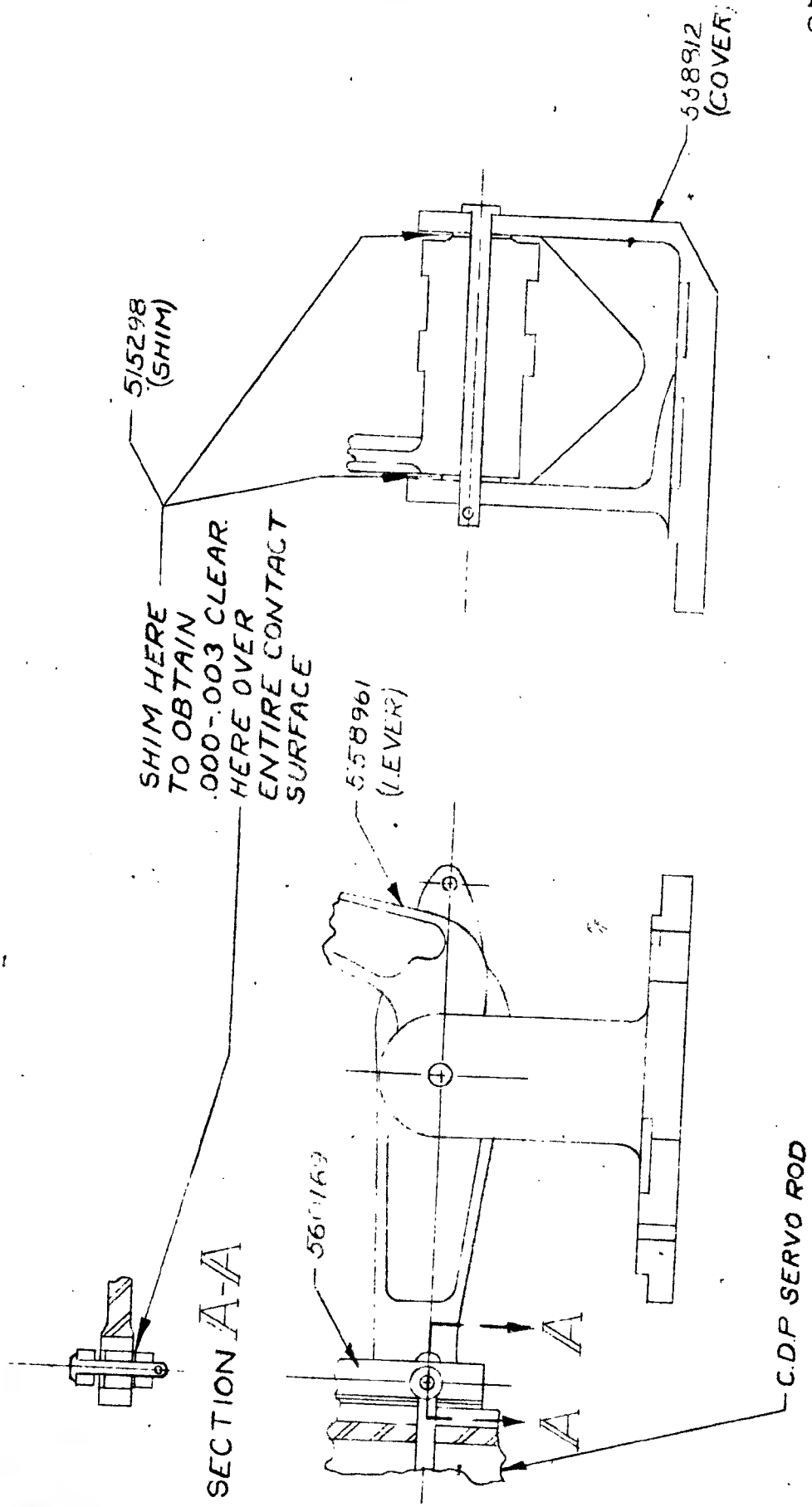
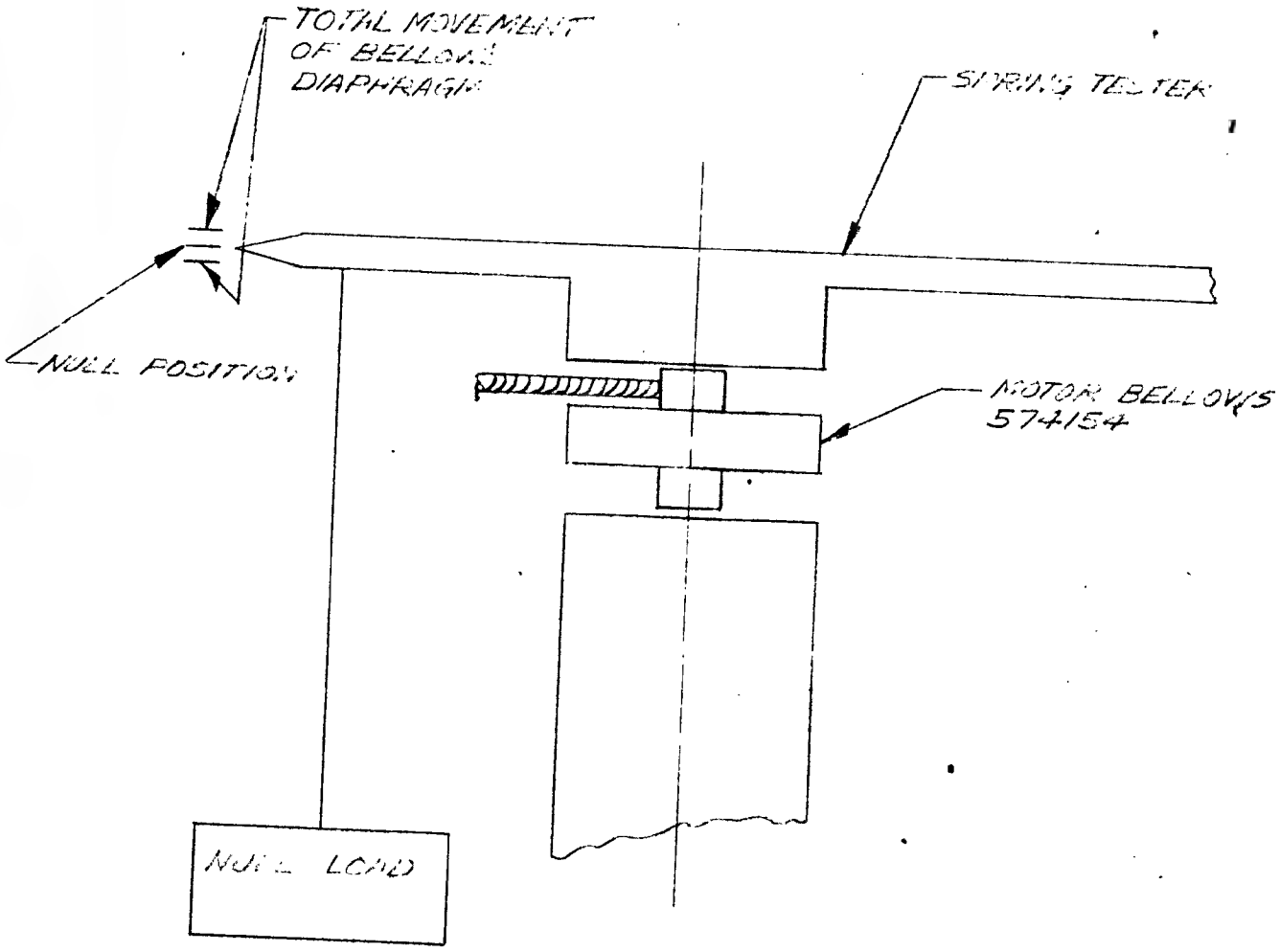
JFC-51
THROTTLE VALVE LINKAGE

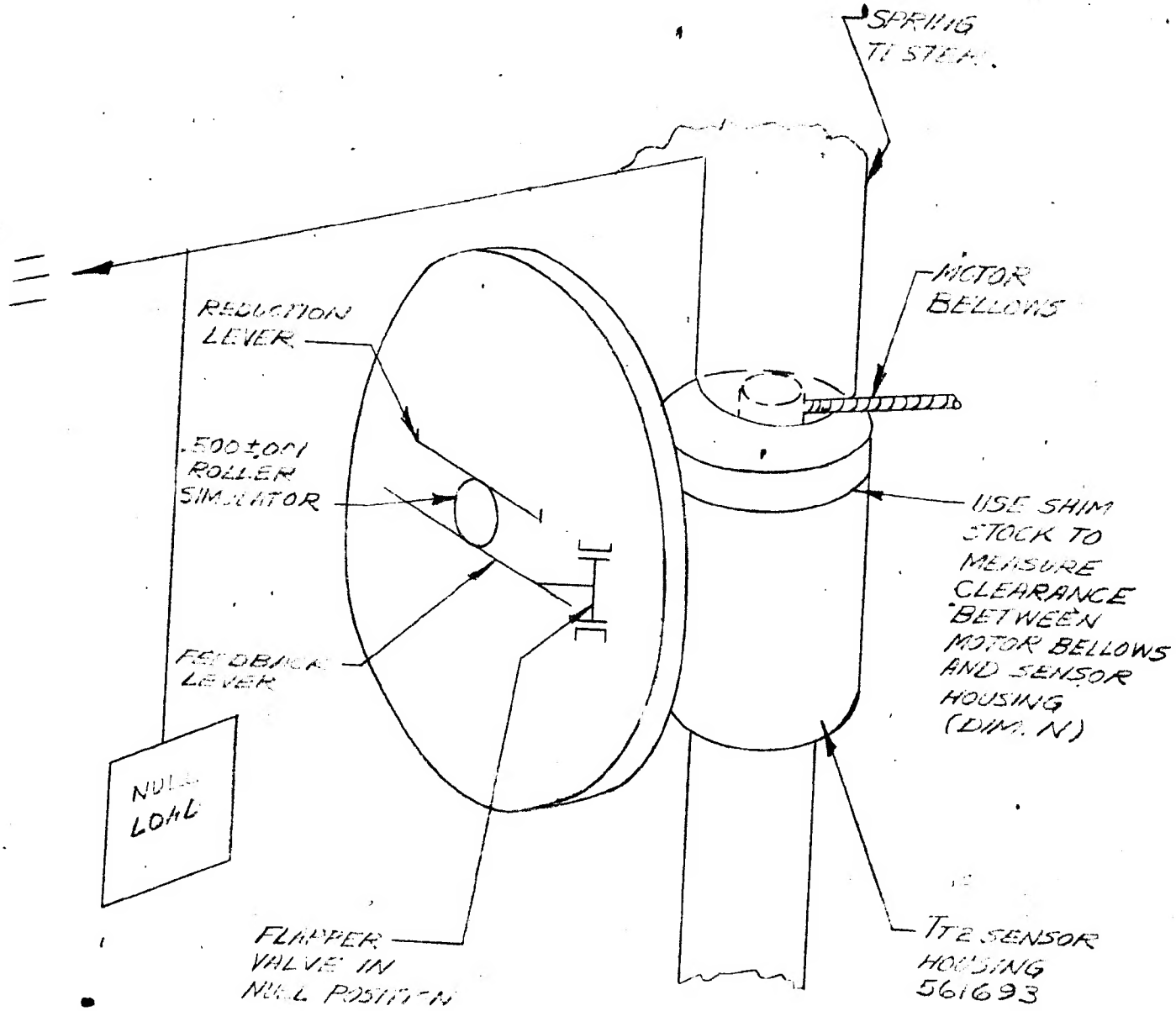




DETERMINATION OF MOTOR BELLOWS NULL LOAD

FIGURE 29

FIGURE 30



DETERMINATION OF DIM. N

FOR SCREW SETTING

ASSEMBLY - PUMP CONTROL

Sensor Piston

Obtain dimension A on Servo Piston (1)

Dimension A = _____

Utilizing fixture 568400 T-81

Obtain Dimension B on Pump Control

Housing Bore for Servo Piston

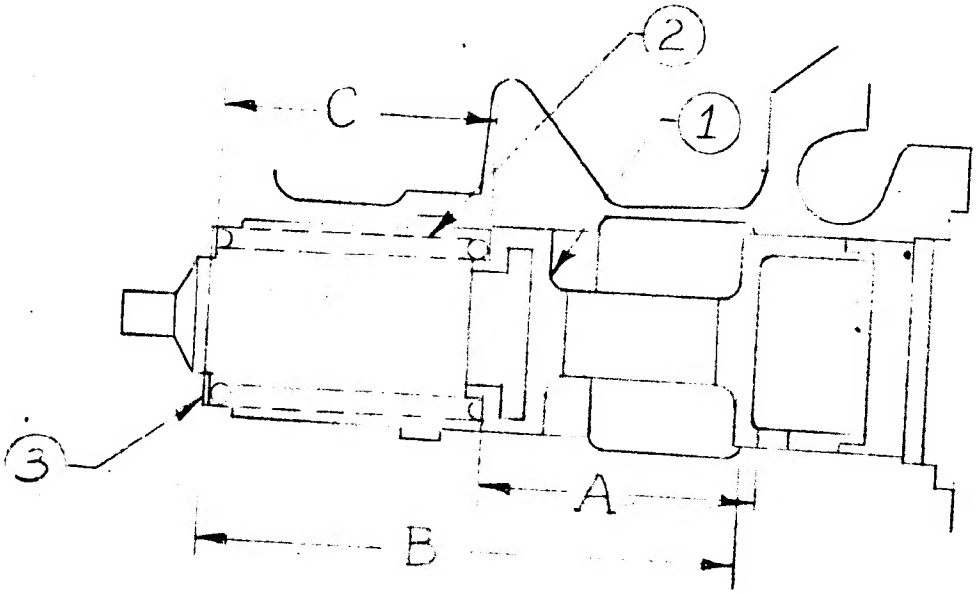
Dimension B = _____

Measure height of Sensor Piston Spring (2) with a 24 lb load applied to spring

Dimension C = _____

Shim thickness = (B + .080) - (A & C)

Shim under Sensor Piston Spring with Shim (3)



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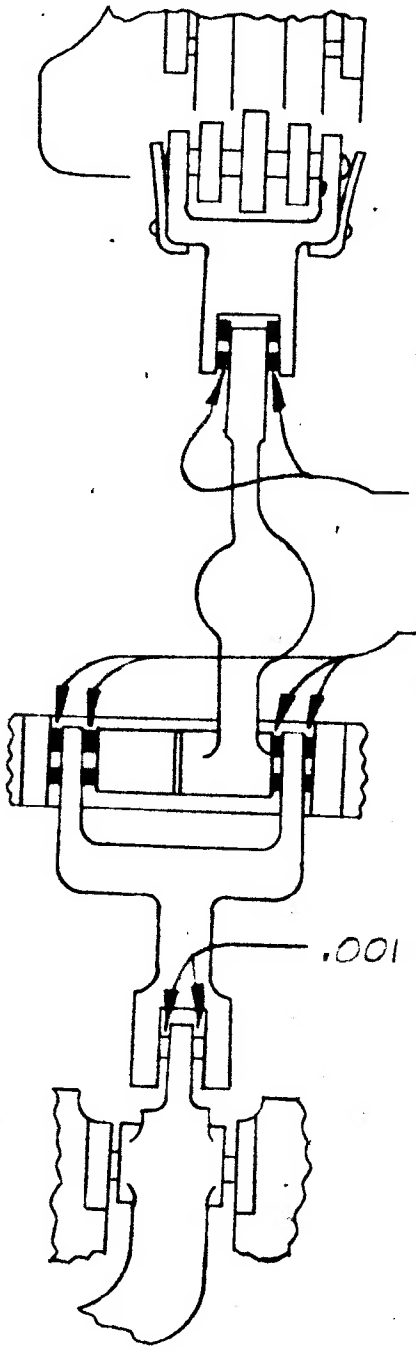

C.P.D. LINKAGE

5-18-62
FIGURE 32

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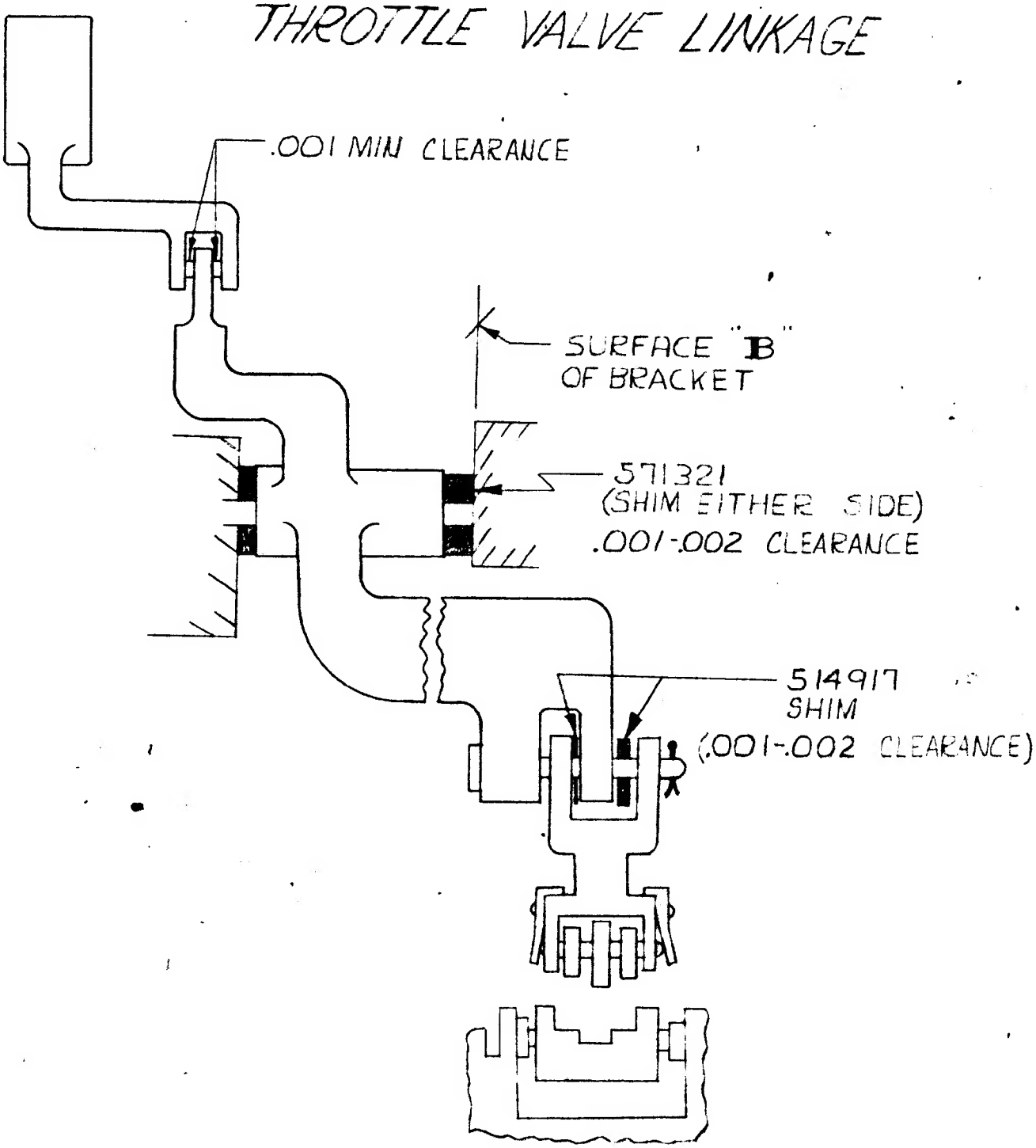
THROTTLE VALVE LINKAGE



5-18-62
FIGURE 33